

Ashley M. Gjovik, JD

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**UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA**

Case No. 3:23-cv-04597-EMC

Filed: September 7 2023

District Judge: Honorable Edward M. Chen

ASHLEY GJOVIK, an individual,

Plaintiff,

v.

APPLE INC, a corporation,

Defendant.

MOTION FOR JUDICIAL NOTICE

Filed: December 25 2023

ADDITIONAL EXHIBITS

Hearing

Dept: Courtroom 5, 17th Floor (Virtual)

Date: February 8, 2024 1:30 p.m.

Motion for Judicial Notice Cover Page: Exhibit 1

825 Stewart / TRW Microwave

Declaration: I verified the authenticity of each of these documents. A true and correction version of each document is attached in each exhibit. I declare under penalty of perjury this is true and correction. /s/ Ashley M. Gjovik (January 2 2024).

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MOTION FOR JUDICIAL NOTICE (PART II)
ADDITIONAL EXHIBIT

SECTION:
TCE TSCA

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Content Details



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u=https://www.govinfo.gov/app/details/FR-2023-10-31/2023-23010)

(mailto:?subject=88 FR 74712 - Trichloroethylene (TCE); Regulation Ur

the Toxic Substances Control Act (TSCA) - Content Details - 20

23010&body=https%3A%2F%2Fwww.govinfo.gov%2Fapp%2Fdetails%2F

2023-10-31%2F2023-23010)

88 FR 74712 - Trichloroethylene (TCE); Regulation Under the Toxic Substances Control Act (TSCA)

Summary

Document in Context ⓘ

Related Docs ⓘ

Publication Title

Federal Register Volume 88, Issue 209 (October 31, 2023)

Category

Regulatory Information

Collection

Federal Register

SuDoc Class Number

AE 2.7:

GS 4.107:

AE 2.106:

Publisher

Office of the Federal Register, National Archives and Records Administration

Section

Proposed Rules

Action

Proposed rule.

Dates

Comments must be received on or before December 15, 2023. Under the Paperwork Reduction Act (PRA), comments on the information collection provisions are best assured of consideration if the Office of Management and Budget (OMB) receives a copy of your comments on or before November 30, 2023.

Contact



For technical information contact: Gabriela Rossner, Existing Chemicals Risk Management Division, Office of Pollution Prevention and Toxics, Environmental Protection Agency, 1200 Pennsylvania Ave. NW, Washington, DC 20460-0001; telephone number (202) 565-2426; email

Summary

The Environmental Protection Agency (EPA) is proposing to address the unreasonable risk of injury to human health presented by trichloroethylene (TCE) under its conditions of use as documented in EPA's November 2020 Risk Evaluation for TCE and January 2023 revised risk determination for TCE pursuant to the Toxic Substances Control Act (TSCA). TCE is widely used as a solvent in a variety of industrial, commercial and consumer applications including for hydrofluorocarbon (HFC) production, vapor and aerosol degreasing, and in lubricants, greases, adhesives, and sealants. TSCA requires that when EPA determines a chemical substance presents unreasonable risk that EPA address by rule the unreasonable risk of injury to health or the environment and apply requirements to the extent necessary so the chemical no longer presents unreasonable risk. EPA determined that TCE presents an unreasonable risk of injury to health due to the significant adverse health effects associated with exposure to TCE, including non-cancer effects (liver toxicity, kidney toxicity, neurotoxicity, immunotoxicity, reproductive toxicity, and developmental toxicity) as well as cancer (liver, kidney, and non-Hodgkin lymphoma) from chronic inhalation and dermal exposures to TCE. TCE is a neurotoxicant and is carcinogenic to humans by all routes of exposure. The most sensitive adverse effects of TCE exposure are non-cancer effects (developmental toxicity and immunosuppression) for acute exposures and developmental toxicity and autoimmunity for chronic exposures. To address the identified unreasonable risk, EPA is proposing to: prohibit all manufacture (including import), processing, and distribution in commerce of TCE and industrial and commercial use of TCE for all uses, with longer compliance timeframes and workplace controls for certain processing and industrial and commercial uses (including proposed phaseouts and time-limited exemptions); prohibit the disposal of TCE to industrial pre-treatment, industrial treatment, or publicly owned treatment works, with a time-limited exemption for cleanup projects; and establish recordkeeping and downstream notification requirements.

Agency Name

ENVIRONMENTAL PROTECTION AGENCY

Page Number Range

74712-74794

Federal Register Citation

88 FR 74712

RIN Number

2070-AK83

CFR Citation

40 CFR 751

CFR Associated Subjects

Environmental Protection; Chemicals; Export Notification; Hazardous Substances; Import Certification and Reporting and Recordkeeping

Docket Numbers

EPA-HQ-OPPT-2020-0642, FRL-8317-01-OCSP

FR Doc Number

2023-23010



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SECTION:

Property Sales Press Releases

GI Partners Announces Acquisition of 825 Stewart Drive in Sunnyvale, California

DataCore Purchases Critical-Use Office / Technology Property

NEWS PROVIDED BY

GI Partners →

31 May, 2016, 08:01 ET

SAN FRANCISCO, May 31, 2016 /PRNewswire/ -- GI Partners announced that it has completed the acquisition of 825 Stewart Drive located in Sunnyvale, California. The acquisition was made through DataCore, L.P. ("DataCore"), a \$500 million fully discretionary core real estate fund managed by GI Partners on behalf of The California State Teachers' Retirement System ("CalSTRS").

825 Stewart Drive is an approximately 75,000 square foot class A office and R&D property developed in 1968 and subsequently repositioned in 2002 and 2015. The property is 100% leased to a prominent technology company.

"On behalf of DataCore, GI is pleased to add 825 Stewart to our growing technology-advantaged real estate portfolio," commented Mike Armstrong, Principal of GI Partners. "The confluence of existing tenancy, use, and the burgeoning ecosystem of global technology companies in the immediate vicinity presents an attractive opportunity."

CalSTRS and GI Partners created DataCore in 2012 as a core investment vehicle to invest in technology-advantaged real estate in the United States, including data centers, internet gateways, corporate campuses for technology tenants, and life science properties, located in primary markets and leased to industry-leading tenants. Since inception, DataCore has acquired approximately 1.8 million square feet of properties throughout the United States.

About CalSTRS

The California State Teachers' Retirement System, with a portfolio valued at \$187.4 billion as of April 30, 2016, is the largest educator-only pension fund in the world. CalSTRS administers a hybrid retirement system, consisting of traditional defined benefit, cash balance and voluntary defined contribution plans. CalSTRS also provides disability and survivor benefits. CalSTRS serves California's 896,000 public school educators and their families from the state's 1,700 school districts, county offices of education and community college districts.

About GI Partners

Founded in 2001, GI Partners is a leading private investment firm based in San Francisco, California. The firm currently manages over \$12 billion in capital commitments through private equity and real estate strategies for recognized institutional investors, including some of the largest state and sovereign pension funds in North America, Europe, Australia, Asia, and the Middle East. GI Partners' real estate team invests across a number of property types and investment strategies, including industrial, apartments, life sciences, and technology-oriented data centers and corporate campuses. For more information on GI Partners, please visit www.gipartners.com.

Contact: Chris Tofalli

Chris Tofalli Public Relations

914-834-4334

chris@tofallipr.com

SOURCE GI Partners

Related Links

<http://www.gipartners.com>



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Hines/Oaktree Venture Acquires 825 Stewart in Sunnyvale

May 19, 2014



(SUNNYVALE, CA) – Hines, the international real estate firm, today announced that, along with a real estate fund managed by Oaktree Capital Management, L.P. (Oaktree), it has acquired 825 Stewart Drive, a 75,350-square-foot office asset in Sunnyvale, CA, from Pacific Landmark, LLC. Financials on the deal were not disclosed.



As originally constructed in 1968, the property consisted of a 45,768-square-foot, single-story building. In 2002, the property underwent a renovation which included a 29,582-square-foot, two-story addition. The property is located on more than four acres in the heart of Silicon Valley and has excellent access to Highway 101, Lawrence Expressway, Central Expressway, and Caltrain in downtown Sunnyvale.

Currently vacant, 825 Stewart will undergo a complete redevelopment under its new ownership. After the approximately nine-month process, the asset will be a substantially modernized office building that will appeal to both creative and more traditional technology industry tenants.

Improvements to the property will include a seismic upgrade, complete replacement of building systems, new glazing and exterior painting, new landscaping, an all-new lobby, and a market-ready tenant build out.

Hines Senior Managing Director George Clever, said, "We are excited to add 825 Stewart to our portfolio and to redevelop the asset into a modern office project that meets the needs of today's tenants. With our upgrade plans for the property and the area's overall improving market fundamentals, we expect 825 Stewart to be a desirable place for business."

"The Oaktree/Hines partnership is well capitalized and, given the quality of this location, we believe we can effectively return this attractive asset to the market," said Ambrose Fisher, managing director for Oaktree.

About Oaktree

Oaktree is a leader among global investment managers specializing in alternative investments, with \$86.2 billion in assets under management as of March 31, 2014. The firm emphasizes an opportunistic, value-oriented and risk-controlled approach to investments in distressed debt, corporate debt (including high yield debt and senior loans), control investing, convertible securities, real estate and listed equities. Headquartered in Los Angeles, the firm has over 800 employees and offices in 16 cities worldwide. For additional information, please visit Oaktree's website at www.oaktreecapital.com.

About Hines

Hines is a privately owned real estate firm involved in real estate investment, development and property management worldwide. The firm's historical and current portfolio of projects that are underway, completed, acquired and managed for third parties includes 1,317 properties representing more than 541 million square feet of office, residential, mixed-use, industrial, hotel, medical and sports facilities, as well as large, master-planned communities and land developments. Currently, Hines manages 391 properties totaling 161 million square feet, which includes 89.1 million square feet for third parties. With offices in 115 cities in 18 countries, and controlled assets valued at approximately \$28.2 billion, Hines is one of the largest real estate organizations in the world. Hines is also a world leader in sustainable real estate strategies, with extensive experience in LEED®, ENERGY STAR®, BREEAM, Haute Qualité Environnementale and DGNB green building rating systems. Visit www.hines.com for more information.

BUSINESS > **REAL ESTATE** • News**SUBSCRIBER ONLY**

Apple-leased Silicon Valley office building is bought as value jumps

Despite Bay Area office weakness, some properties gain value



(Google Maps)

825 Stewart Drive, an office and research building in Sunnyvale that totals 75,400 square feet.



By **GEORGE AVALOS** | gavalos@bayareanewsgroup.com | Bay Area News Group

PUBLISHED: August 29, 2023 at 5:30 a.m. | UPDATED: September 5, 2023 at 8:44 a.m.



SUNNYVALE — A big Sunnyvale building occupied by tech titan Apple has been bought in a deal that shows pockets of strength in a feeble Bay Area office market.

A veteran real estate firm paid \$41 million for the office and research building in Sunnyvale, according to documents filed on Aug. 28 at the Santa Clara County Recorder's Office.

An affiliate managed by BentallGreenOak bought the office and research building, which is located at 825 Stewart Drive in Sunnyvale, the county real estate records show.



Office and research building at 825 Stewart Drive in Sunnyvale that totals 75,400 square feet. (Google Maps)

The building totals nearly 75,400 square feet and for several years has been fully leased to Cupertino-based Apple.

The purchase by BGO 825 Stewart, the BentallGreenOak affiliate, points to rising property values for the office and research building, which occupies 4.3 acres.

In 2016, the seller, an affiliate of real estate firm GI Partners, paid \$34.7 million for the office building, county records show.

The deal demonstrates that even though sky-high office vacancies haunt the Bay Area, some properties are still gaining value.

The recent purchase price of \$41 million is 18.2% higher than what GI Partners paid seven years earlier.

By happenstance, the site once was a Superfund cleanup site in connection with a groundwater contamination incident from decades ago involving a long-departed building occupant, TRW Microwave. Northrup Grumman, which had bought TRW Microwave, has taken responsibility for the cleanup, federal officials report.

This spring, GI Partners hired JLL, a commercial real estate firm, to market the office building.

The building was renovated in 2015, and Apple added some wide-ranging improvements of its own to the property, according to JLL.

It wasn't immediately clear what sort of work Apple does inside the building.

"The two-story property offers highly specialized lab improvements," JLL stated in March.

JLL brokers Will Connors, Daniel Renz, Michael Manas, Cheri Pierce, Kendall Willet and Aisling Duffy led the search for a buyer.

"825 Stewart is a tremendous opportunity to acquire a highly specialized facility occupied by one of the world's largest technology companies in one of the most diverse tech economies in the country," JLL broker Connors said.

The office building drew plenty of interest when it was placed on the market, according to JLL.

"The specialized lab improvements, coupled with the tenant's significant capital investments, created a compelling value proposition and competitive buyer pool," Manas said.



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MOTION FOR JUDICIAL NOTICE (PART II)
ADDITIONAL EXHIBIT

SECTION:

**2016 VI Report
from Apple**



Sunnyvale

CONSOLIDATED INSPECTION REPORT
DEPARTMENT OF PUBLIC SAFETY
FIRE PREVENTION & HAZARDOUS MATERIALS
CERTIFIED UNIFIED PROGRAM AGENCY
 505 W. Olive Ave, Suite 150
 Sunnyvale, CA 84086
 (408) 730-7212 | Fax: (408) 328-0726
 FirePrevention@Sunnyvale.ca.gov

CONSOLIDATED INSPECTION REPORT

Facility Name: Apple Inc. - Stewart Drive 1 **CERS ID:** 10687162 **Purpose:** Routine **Date:** 09/09/2021
Address: 825 Stewart Dr Sunnyvale CA 94085 **Consent to Inspect Granted:** ☒ **By:** Tom Huynh

OBSERVATIONS AND CORRECTIVE ACTIONS

Fire Prevention - HazMat

36 - **Observation:** PCI Cart with misc. storage is present in the facility's exterior electrical room.
Code Section: CFC 315.3.3
Violation Type: Repeat
Correct By: 10/09/2021

Additional Comments: Fire extinguishers are current.

5-year riser certification was performed April 2017. Annual riser certification was performed Oct. 2020.

Flammable storage cabinets are utilized and are self closing.

Secondary containment is provided - clean and dry.

No signature obtained due to COVID-19 protocols. Verbal consent to inspect granted.

This report shall serve as a "NOTICE TO COMPLY" for Minor Violations, and a "NOTICE OF VIOLATION" for Class I or II violations. You are, hereby, ordered to correct the above noted violations within 30 days, or as otherwise specified. Formal enforcement and/or penalty assessment may be initiated at any time without further notice for Class I or II violations noted, and for Minor violations not corrected within 30 days.

OBSERVATIONS AND CORRECTIVE ACTIONS

Hazardous Waste Generator - Small Quantity Generator - Routine

Additional Comments: Hazardous waste is properly labeled.

Solder waste is collected at the point of generation. Discussed housekeeping of solder areas.

Accumulation times - OK.

Manifests - OK. Log documenting when manifests are sent to DTSC are maintained.

No signature obtained due to COVID-19 protocols. Verbal consent to inspect granted.

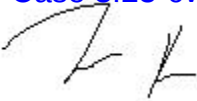
There were no violations observed during this inspection.

All violations must be corrected within 30 days of the date of this notice unless otherwise noted. H&SC 25187.8 requires that you write a brief description of the corrective action taken to bring this facility into compliance and submit that information to this office by email or fax within 5 days of achieving compliance.

Corrective Action Taken: PCI cart was removed from the facilities exterior electrical room following the HazMat inspection.

Certification: I certify under penalty of perjury that this facility has corrected all items identified in this Notice of Violation.

Name of Owner/Operator: Austin J DeBaene **Signature:** *Austin J DeBaene* **Date:** 11/17/21



Inspected By: _____
Morgan Kaman



Facility Representative: _____
Tom Huynh

California Environmental Reporting System (CERS)

Submittal Summary

Apple Inc. - Stewart Drive 1 (CERSID: 10687162)**Facility Information Accepted Mar 2, 2021**

Submitted on 2/26/2021 3:21:04 PM by *Austin DeBaene* of APPLE, Inc- Sunnyvale (Sunnyvale, CA)
 Submittal was **Accepted** on 3/2/2021 12:47:21 PM by m Kaman

- Business Activities
- Business Owner/Operator Identification
- Locally-Required Documentation
 - Provided In Submittal Element: Facility Information

Hazardous Materials Inventory Accepted Mar 2, 2021

Submitted on 2/26/2021 3:21:04 PM by *Austin DeBaene* of APPLE, Inc- Sunnyvale (Sunnyvale, CA)
 Submittal was **Accepted** on 3/2/2021 12:47:37 PM by m Kaman

- Hazardous Material Inventory (1)
- Site Map (Official Use Only)
 - *SD0101 HMBP MAP 06152017* (Adobe PDF, 628KB)
 - *SD01 SITE MAP 06152017* (Adobe PDF, 1290KB)

Guidance Messages

- **Warning:**
 1. Hazardous Material Inventory - Data Element "Federal Hazard Category = Pressure Release" for material "ARGON, COMPRESSED", location "Stewart Drive/SD01-Castle Black-1215" is obsolete. Obsolete Data Elements should be updated and/or replaced with valid Data Elements before submitting your inventory.
 2. Hazardous Material Inventory - Data Element Code "Other Health Hazard" for Data Element "Hazard Class 1", material "ARGON, COMPRESSED", location "Stewart Drive/SD01-Castle Black-1215" is obsolete. Obsolete Data Element Codes should be updated and/or replaced with valid Data Element Codes before submitting your inventory.

Emergency Response and Training Plans Accepted Mar 2, 2021

Submitted on 2/26/2021 3:21:04 PM by *Austin DeBaene* of APPLE, Inc- Sunnyvale (Sunnyvale, CA)
 Submittal was **Accepted** on 3/2/2021 12:48:33 PM by m Kaman

- Emergency Response/Contingency Plan
 - *2020 SD01 Emergency Response/Contingency Plan* (Adobe PDF, 366KB)
- Employee Training Plan
 - *Employee Training Plan* (Adobe PDF, 153KB)

California Environmental Reporting System (CERS)

Business Activities

Site Identification

Apple Inc. - Stewart Drive 1

825 Stewart Dr
Sunnyvale, CA 94085
County
Santa Clara

CERS ID
10687162
EPA ID Number
CAL000416631

Submittal Status

Submitted on 2/26/2021 by *Austin DeBaene* of APPLE, Inc- Sunnyvale (Sunnyvale, CA)
Submittal was **Accepted**; Processed on 3/2/2021 by *m Kaman* for Sunnyvale Department of Public Safety

Hazardous Materials

Does your facility have on site (for any purpose) at any one time, hazardous materials at or above 55 gallons for liquids, 500 pounds for solids, or 200 cubic feet for compressed gases (include liquids in ASTs and USTs); or is regulated under more restrictive inventory local reporting requirements (shown below if present); or the applicable Federal threshold quantity for an extremely hazardous substance specified in 40 CFR Part 355, Appendix A or B; or handle radiological materials in quantities for which an emergency plan is required pursuant to 10 CFR Parts 30, 40 or 70?

No

Underground Storage Tank(s) (UST)

Does your facility own or operate underground storage tanks?

No

Hazardous Waste

Is your facility a Hazardous Waste Generator?

No

Does your facility treat hazardous waste on-site?

No

Is your facility's treatment subject to financial assurance requirements (for Permit by Rule and Conditional Authorization)?

No

Does your facility consolidate hazardous waste generated at a remote site?

No

Does your facility need to report the closure/removal of a tank that was classified as hazardous waste and cleaned on-site?

No

Does your facility generate in any single calendar month 1,000 kilograms (kg) (2,200 pounds) or more of federal RCRA hazardous waste, or generate in any single calendar month greater than 1 kg (2.2 pounds) of RCRA acute hazardous waste; or generate more than 100 kg (220 pounds) of spill cleanup materials contaminated with RCRA acute hazardous waste.

No

Is your facility a Household Hazardous Waste (HHW) Collection site?

No

Excluded and/or Exempted Materials

Does your facility recycle more than 100 kg/month of excluded or exempted recyclable materials (per HSC 25143.2)?

No

Aboveground Petroleum Storage

Does your facility own or operate aboveground petroleum storage tanks or containers AND:

- * have a total aboveground petroleum storage capacity of 1,320 gallons or more, OR
- * have one or more petroleum tanks in an underground area?

No

Regulated Substances

Does your facility have Regulated Substances stored onsite in quantities greater than the threshold quantities established by the California Accidental Release prevention Program (CalARP)?

No

Additional Information

No additional comments provided.

California Environmental Reporting System (CERS)

Business Owner Operator

Facility/Site

Apple Inc. - Stewart Drive 1

825 Stewart Dr
Sunnyvale, CA 94085

CERS ID
10687162

Submittal Status

Submitted on 2/26/2021 by *Austin DeBaene* of APPLE, Inc- Sunnyvale (Sunnyvale, CA)
Submittal was **Accepted**; Processed on 3/2/2021 by *m Kaman* for Sunnyvale Department of Public Safety

Identification

Apple Inc.	Beginning Date	Ending Date
Operator Phone (408) 996-1010	Business Phone (408) 996-1010	Business Fax
Dun & Bradstreet 060704780	SIC Code 3571	Primary NAICS 33411

Facility/Site Mailing Address

One Apple Park Way, M/S 119 EHS
Cupertino, CA 95014

Primary Emergency Contact

Austin DeBaene
Title
EHS Lead
Business Phone
(309) 230-3617
24-Hour Phone
(408) 974-3333
Pager Number

Owner

Apple Inc.
(408) 996-1010
One Apple Park Way, M/S 119 EHS
Cupertino, CA 95014

Secondary Emergency Contact

Tracey Scott
Title
EHS Manager
Business Phone
(408) 862-1241
24-Hour Phone
(408) 974-3333
Pager Number

Billing Contact

Kevin Sung
(408) 908-0167
Kevin_Sung@apple.com
One Apple Park Way, M/S 119 EHS
Cupertino, CA 985014

Environmental Contact

Celine Granger
(408) 204-1687
celine_granger@apple.com
One Apple Park Way, M/S 119-EHS
Cupertino, CA 95014

Name of Signer

Austin DeBaene

Signer Title

EHS Lead

Document Preparer

BSI

Additional Information

Locally-collected Fields

Some or all of the following fields may be required by your local regulator(s).

Property Owner

GI DC Sunnyvale LLC
Phone
(415) 688-4818
Mailing Address
188 The Embarcadero, Suite 700
San Francisco, CA 94105

Assessor Parcel Number (APN)

205-21-008

Number of Employees

Facility ID

Hazardous Materials And Wastes Inventory Matrix Report

CERS Business/Org. APPLE, Inc- Sunnyvale		Chemical Location				CERS ID 10687162
Facility Name Apple Inc. - Stewart Drive 1		Stewart Drive/SD01-Castle Black-1215				Facility ID
825 Stewart Dr, Sunnyvale 94085						Status Submitted on 2/26/2021 3:21 PM

DOT Code/Fire Haz. Class	Common Name	Unit	Quantities			Annual Waste Amount	Federal Hazard Categories	Hazardous Components (For mixture only)		
			Max. Daily	Largest Cont.	Avg. Daily			Component Name	% Wt	EHS CAS No.
DOT: 2.2 - Nonflammable Gases	ARGON, COMPRESSED	Cu. Feet	250	250	250		- Pressure	Argon	100%	7440371
Other Health Hazard	<u>CAS No</u>	<u>State</u>	<u>Storage Container</u>		<u>Pressue</u>	<u>Waste Code</u>	Release			
	7440371	Gas	Cylinder		> Ambient					
	Map: SD0101 Grid: H7	<u>Type</u>			<u>Temperature</u>					
	Pure	Days on Site: 365		Ambient						

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MOTION FOR JUDICIAL NOTICE (PART II)
ADDITIONAL EXHIBIT

SECTION:

**2016 VI Report
from Apple**

From: MORASH, MELANIE
Sent: Wednesday, March 02, 2016 10:23 AM
To: Niemeyer, Linda (CO) (Contr); Hadlock, Holly
Cc: Mora, Rebecca; Holbrook, Holly; Kwan, Joseph P (CO); Shaffer, Caleb; DIAZ, ALEJANDRO; Plate, Mathew; Stralka, Daniel
Subject: EPA Approval - VI Evaluation Report - TRW Microwave Site

Good morning, Linda,

Thank you for submitting the February 2016 Vapor Intrusion Evaluation Report, for the TRW Microwave Site at 825 Stewart Drive in Sunnyvale, CA.

This report documents no evidence of unacceptable vapor intrusion into the building that could adversely affect building occupants. The sampling was conducted following the installation of a passive sub-slab vapor venting mitigation system (with the capability to be converted to active at a later date if conditions so require) and the subsequent tenant improvements performed by the tenant, Apple, Inc.

Sampling activities included the collection of sub-slab, indoor air, and outdoor air samples. Of the five indoor air samples collected, the highest level of trichloroethene (TCE) detected was 0.58 micrograms per cubic meter (ug/m3), which does not exceed any of the project screening levels. Additionally, the sampling results demonstrate no effect of the tenant improvements on the performance of the VI mitigation system.

EPA approves the findings outlined in this report, and concurs with your recommendation to re-sample in the event that building conditions change in the future, such as additional tenant improvements (as may occur if tenancy changes) that may create new VI conduits and/or impair the integrity of the concrete slab or passive vapor collection system.

Regards,

Melanie Morash

Melanie Morash, Project Manager
California Site Cleanup Section I, Superfund Division

US EPA Region 9
75 Hawthorne Street (SFD-7-1)
San Francisco, CA 94105

(415) 972-3050 [phone]
morash.melanie@epa.gov

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MOTION FOR JUDICIAL NOTICE (PART II)
ADDITIONAL EXHIBIT

SECTION:

**2016 VI Report
from Apple**

<https://semspub.epa.gov/work/09/1158560.pdf>

SEMS-RM DOCID # 1158560



VAPOR INTRUSION EVALUATION REPORT

**FORMER TRW MICROWAVE SITE
825 STEWART DRIVE
SUNNYVALE, CALIFORNIA**

Prepared for:
Apple Inc.

Prepared by:
AECOM
999 W. Town and Country
Orange, CA 92868

FEBRUARY 2016

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EXECUTIVE SUMMARY

This Vapor Intrusion Evaluation Report (Report) has been prepared by AECOM Technical Services, Inc. (AECOM) on behalf of Apple Inc. (Apple) to present the results of vapor intrusion (VI) evaluation sampling performed on 29 December 2015 at the former TRW Microwave Site (the Site) located in the City of Sunnyvale, California. The results of this sampling effort were used to assess whether vapor intrusion risk has changed due to tenant improvements.

Sampling activities included collection of three sub-slab samples, nine indoor air samples, and one outdoor ambient air sample. All vapor samples collected from the sub-slab vapor monitoring points were analyzed for volatile organic compounds (VOCs) and all indoor and outdoor air samples were analyzed for selected VOCs including those chemicals identified as chemicals of concern (COCs) in groundwater and additional chemicals identified during previous indoor air sampling events at the building.

The cumulative risk for the primary VI risk drivers in indoor air ranged from 1×10^{-7} to 4×10^{-7} and the Hazard Index (HI) was below 0.1. Therefore, chemicals detected in indoor air do not pose a human health risk under a commercial / industrial exposure scenario. These results are based on the current building conditions, and no further sampling is warranted. However, if building conditions change in the future where the sub-slab foundation is affected and/or other VI conduits are created, then an additional monitoring event will be performed utilizing the same sampling methodology and adjusting the sampling location rationale based on the building layout/buildout at the time of sampling.

1.0 INTRODUCTION

This Vapor Intrusion Evaluation Report (Report) has been prepared by AECOM Technical Services, Inc. (AECOM) on behalf of Apple Inc.(Apple) to present the results of vapor intrusion (VI) evaluation sampling performed on 29 December 2015 at the former TRW Microwave Site (the Site) located in the City of Sunnyvale, California (Figure 1). Figure 2 shows the current Site layout.

All work was performed in accordance with the Work Plan Addendum #2 for Vapor Intrusion Evaluation Sampling and Analysis (VI Work Plan Addendum #2, AECOM 2015a) with the exceptions discussed in Section 2.0. The results of this sampling effort were used to assess whether VI risk has changed due to tenant improvements.

1.1 Background

During the Five-Year Review process conducted in accordance with the requirements of the Record of Decision, the VI pathway was identified as requiring evaluation for protectiveness. VI investigations were performed at the Site between 2003 and 2004 and the results of these investigations are summarized in the Third Five-Year Review Report (Camp Dresser & McKee, Inc. 2009).

An additional VI investigation was performed in 2013 in response to the December 6, 2012 Requirement for Vapor Intrusion Sampling and Analysis Work Plan and Report letter from the San Francisco Regional Water Quality Control Board (RWQCB). The purpose of the 2013 VI investigation was to update the VI pathway evaluation to reflect any changes in site conditions.

In 2014, at the request of the property owner and as a conservative, proactive measure, it was agreed to install a passive Sub-Slab Vapor Collection (SVC) system below the existing site building. In August and September 2014, the passive SVC system was installed beneath the concrete floor of the entire building in accordance with the Passive Sub-Slab Vapor Collection System Installation Work Plan (AECOM 2014). The purpose of the passive SVC system is to passively collect vapors below the building slab and vent them to the atmosphere as a protective measure against any current or future vapor intrusion. The layout of the passive SVC system is shown on Figure 3.

After installation of the passive SVC system and patching of potential VI conduits was complete, a post-construction sampling event was performed in May 2015. The purpose of the May 2015 sampling event was to: 1) assess the VI pathway under then current Site conditions; 2) evaluate the efficacy of the passive SVC system; and 3) support attainment of a certificate of occupancy from the City of Sunnyvale after evaluation of analytical results. Results of the May 2015 sampling are described below.

1.1.1 May 2015 Vapor Intrusion Evaluation Sampling Event

Indoor air, outdoor air, and sub-slab vapor sampling were performed in May 2015. Tables 1 and 2 summarize sub-slab vapor and indoor/outdoor air sampling results, respectively. The results of the May 2015 sampling indicated that there was no VI-related chemical that presented a cancer risk equal to or above a 1×10^{-6} exposure level and the hazard index (non-cancer risk) (HI) was less than 1 under the industrial exposure scenario. These results were below the state and federal industrial screening levels (used as project action levels [PALs]) (Table 3) and indicated no risk to human health under the industrial exposure scenario. The sampling methodology, as well as details of how these risks were calculated, are discussed in detail in the Vapor Intrusion Evaluation Report (AECOM 2015b).

Building conditions at the time of sampling were assumed to represent a worst-case scenario for potential VI due to the absence of mechanical ventilation (e.g., heating, ventilating, and air conditioning [HVAC] off), which would not be representative of normal working conditions in most industrial buildings.

1.1.2 Changes in Site Conditions Subsequent to May 2015 VI Evaluation Sampling

The building conditions changed since the previous May 2015 sampling event due to tenant improvements performed in late 2015. These improvements included installation of interior walls (for buildout of cubicles and enclosed offices), penetration and subsequent re-sealing of the concrete slab for installation of additional piping and utilities, and installation of interior finishes (e.g., new carpet, tile, and newly-painted walls). Inspections of the floor penetrations, prior to and after re-pouring the concrete to close the floor penetrations, were conducted by AECOM on behalf of Apple to ensure that any areas where a moisture/vapor barrier was present were replaced and secured to the edges of the existing barrier material. Appendix A provides photos showing the foundation repairs that were performed as part of the tenant improvements. Figures 4 and 5 show the current first and second floor layouts of the Site building, respectively.

1.2 Project Objective

The objective of the sampling performed in December 2015 is to assess the VI pathway under current Site conditions now that tenant improvements are complete and all penetrations of the slab have been re-sealed.

This report presents the methods and procedures used for collecting multiple lines of evidence for evaluating the VI pathway and the measures taken to ensure that data obtained are reliable and usable. Data obtained during the VI sampling event were used to assess potential risk to current building occupants. The PALs for groundwater chemicals of concern (COCs) and other additional volatile organic compounds (VOCs) detected at the Site during previous VI investigations are listed in Table 3. These PALs include United States Environmental Protection Agency (USEPA) regional screening levels (RSLs) for indoor air commercial/industrial exposure, published in November 2015 (USEPA 2015a), and the California Department of Toxic Substances Control

(DTSC) Office of Human and Ecological Risk (HERO) Note 3, published in October 2015 (HERO 2015).

1.3 Report Organization

This Report is organized as follows:

- Section 1 provides an introduction, background, and the project objectives.
- Section 2 describes the scope of the investigation, including pre-sampling activities, field activities, laboratory analyses, and quality assurance procedures.
- Section 3 describes how the data were evaluated.
- Section 4 includes interpretation of results, uncertainties inherent in the sampling and data evaluation process, conclusions, and recommendations.
- Section 5 provides references.

2.0 SCOPE OF WORK

The scope of work for this monitoring event included a pre-sampling building survey performed on 22 December 2015 and a VI evaluation sampling event performed on 29 December 2015. The protocol for the soil vapor sampling and analysis followed guidelines in the Advisory – Active Soil Gas Investigations (California Environmental Protection Agency 2012). Other resources that were consulted during preparation of this report and development of the Work Plan include the Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (DTSC 2011a) and the Vapor Intrusion Mitigation Advisory (DTSC 2011b).

Sampling activities included collection of three sub-slab samples (SS-2, SS-5, and SS-10), collection of nine indoor air samples (IA-1 through IA-9), and collection of one outdoor ambient air sample (OA-1). The sub-slab and indoor air sample locations are shown on Figures 4 (first floor) and 5 (second floor). The outdoor air sample was collected on the roof of the building near an HVAC intake. Additional details regarding field activities are provided in the following sections.

2.1 Deviations from the Work Plan

Field activities were performed in accordance with the VI Work Plan Addendum #2 (AECOM 2015a) with the exception of the following:

- The HVAC unit could not be turned off in HVAC Zone 3 (outlined in purple on Figure 4). Per USEPA approval, Indoor Air Sample IA-8 was collected from this area and it was noted that the sample was collected under HVAC-on conditions. All other HVAC zones were turned off during sampling.

- The day of the sampling event, an outside contractor was found to already be working onsite and installing carpet using a spray adhesive (Photograph A-32 in Appendix A). Although the use of spray adhesive immediately prior to the sampling event is outside of typical sampling procedures, the sampling event was conducted as planned as no indoor air samples were located within the immediate vicinity of these activities. The material safety data sheet for the adhesive is provided in Appendix B.
- Indoor Air Sample IA-6 (co-located with Sub-Slab Sample SS-5), was relocated to an area near the original proposed sampling location within the same HVAC Zone, but outside of a secure area. The revised sampling location is shown on Figure 4.
- Two sub-slab monitoring points were replaced with alternate locations. Sample collection from Sub-Slab Monitoring Point SS-7 was attempted three times; however, the seal was found to be compromised as evidenced by detection of the tracer gas helium during pre-sampling leak testing. Therefore, a sample was collected from Sub-Slab Monitoring Point SS-2 instead. This monitoring point is located within the same building area (Section 2, as shown on Figure 3) as Sub-Slab Monitoring Point SS-7, so it fulfills the stated rationale for Sub-Slab Monitoring Point SS-2 of assessing subsurface soil gas conditions in Section 2 of the building. Sub-Slab Monitoring Point SS-11 could not be located. Therefore, Sub-Slab Monitoring Point SS-10, located in the vicinity of Sub-Slab Monitoring Point SS-11, was used instead.

2.2 Sampling Location Selection

2.2.1 Rationale for Sampling Location

In general, indoor air samples for vapor intrusion evaluation were collected in the vicinity of potential VI conduits (i.e., floor drain, elevator shaft) or in areas that are representative of a typical office workspace (DTSC 2011). The building contains four discrete HVAC zones on the first floor, as indicated by the color outlines on Figure 4. A minimum of one indoor air sample was collected in each HVAC zone. Additionally, sample locations were selected to evaluate the VI pathway in each of the three building sections (Sections 1, 2, and 3, as shown on Figure 3).

One sub-slab and four indoor air locations were sampled in Section 1 (the two-story section of the building)/HVAC Zone 1: (1) Indoor Air Sample IA-1, located above the location of the previously removed underground storage tank and recent soil excavation, (2) Indoor Air Sample IA-4, located near the elevator on the first floor, (3) Indoor Air Sample IA-5, located near the elevator on the second floor, and (4) Indoor Air Sample IA-6, co-located with Sub-Slab Sample SS-5.

One sub-slab and four indoor air locations were sampled in Section 2 (central large one-story portion of the building)/HVAC Zones 1, 2, and 3: (1) Indoor Air Sample IA-2 (HVAC Zone 1), located in an office area, (2) Indoor Air Sample IA-7 (HVAC Zone 2), located in an office area and co-located with Sub-Slab Sample SS-2, (3) Indoor Air Sample IA-8 (HVAC Zone 3), located in an office area, and (4) Indoor Air Sample IA-9 (HVAC Zone 1), located in next to a floor drain located within a restroom.

One sub-slab and one indoor air location were sampled in Section 3 (central large one-story portion of the building)/HVAC Zone 4: (1) Indoor Air Sample IA-3, located in next to an office area and co-located with Sub-Slab Sample SS-10.

Outdoor ambient air sample OA-1 was collected on the roof of Section 2, near the intake of the HVAC system, located near the southwestern portion of the building (not shown on Figure 3). Photographs showing sampling equipment layout and helium leak testing are included in Appendix A.

2.3 Pre-Sampling Building Survey

A pre-sampling building survey was conducted on 22 December 2015 to evaluate accessibility of the proposed sampling locations prior to the field sampling event. As discussed in Section 1.1.2, recent tenant improvements included installation of interior walls, penetration and subsequent re-sealing of the concrete slab for installation of additional piping and utilities, and the addition of interior finishes (e.g., new carpet and tile installation and newly-painted walls). In addition to assessing sampling locations, a photoionization detector (PID) was used to detect potential indoor air sources (e.g. cleaning products or other sources that could be removed prior to the sampling event). The HVAC units were operating during this building survey and there were no detections on the PID. Appendix A presents photos taken during the building survey and the building survey forms are presented in Appendix B.

2.4 Sampling Field Activities

Sampling was performed on December 29, 2015 with the HVAC system off. Prior to the start of sampling, the HVAC system was turned off 36 hours prior to sampling. The HVAC system is designed to automatically close the outdoor intakes when the system is turned off, and it was confirmed that all vents were in the closed position after system shutdown occurred. However, the HVAC unit for HVAC Zone 3 (outlined in purple on Figure 4) could not be turned off at the time of sampling. Additionally, not all locations were accessible for collection of field measurements as discussed in Section 2.1.

A PID capable of detecting VOCs to one part per billion (ppb) was used to identify potential sources of VOCs inside the building, as well as to collect readings in the vicinity of the outdoor air sample. As summarized in Table 4, background PID readings during the sampling event within the building were greater than 200 ppb at all locations that were sampled and were generally greater in HVAC Zone 2. Differential pressure measurements (see field data sheets included in Appendix B) ranged from -2.5 pascals (Pa) in HVAC Zone 4 to +12.5 Pa in HVAC Zone 1 (per standard convention, a negative value represents potential air flow from the subsurface into the indoor space). Temperatures inside the building ranged from 50 degrees Fahrenheit (°F) to 60 °F during sampling. Ambient weather conditions prior to and during sampling were dry with no rainfall; the outdoor temperature was in the mid-40s to 50s °F. Wind speed was negligible on the day of sampling, with gusts of up to 4 miles per hour. The barometric pressure in the two days

prior to the sampling date was stable. Sample times and other data were recorded on field data sheets included in Appendix B. The following subsections provide details regarding the procedures followed during sample collection.

2.4.1 Sampling Equipment

All gauges and flow control manifolds were supplied by TestAmerica Laboratories Inc., West Sacramento, California (TAMS), a California-certified laboratory. The gauges and manifolds were connected by chromatography-grade, stainless steel tubing and dedicated airtight, flexible, Teflon® tubing, materials that have a low capacity for adsorbing VOCs. Sample trains were assembled using 0.25-inch outer diameter nylon tubing for all vapor sampling. Swagelok® type connectors were used for connections between tubing and other sampling components.

Samples were collected in 1-liter evacuated, stainless-steel canisters for the sub-slab samples and 6-liter evacuated, stainless-steel canisters for the indoor and outdoor air samples. All canisters were provided by TAMS with all 6-liter canisters individually certified as clean and the 1-liter canisters batch certified as clean. Canister certifications are provided in Appendix C. Each canister was field-verified to have a vacuum of at least 26 inches of mercury (in Hg) prior to sampling. Initial and final vacuum readings were recorded on field forms provided in Appendix B.

2.4.2 Sub-Slab Vapor Sampling

2.4.2.1 Leak Testing

Prior to sampling, AECOM performed leak testing at each sub-slab monitoring point, using laboratory-grade helium introduced into a clear plastic shroud covering the monitoring point (Photograph A-22 in Appendix A). The sampling equipment was connected in a sample train comprised of a PID used as a purge pump and the canister equipped with the laboratory-supplied flow regulator and vacuum gauge. Vapors were drawn from the monitoring point using the PID with built-in motor, and the magnitude of total VOCs was assessed.

Laboratory-grade helium was used as the tracer gas to test for air leakage into the sampling system for the purpose of sample integrity verification. Helium from a cylinder was introduced via a port in the shroud to maintain a concentration of at least 10 percent helium by volume beneath the shroud. The helium concentration under the shroud was monitored using a helium detector via a second port in the shroud. A third port was connected to the PID for purging, leak testing, and measuring total VOCs in the sample. During leak testing, a portable helium detector was connected to the sampling train and used to confirm that helium was not detected in the sample train above a concentration of 5 percent of the helium concentration inside the shroud. The non-detection of helium above this concentration confirmed that the monitoring point was properly sealed and the sampling pump did not draw ambient air into the sample train. Helium measurements recorded during leak testing are provided on field forms included in Appendix B.

Sampling equipment was thoroughly inspected to ensure tight fittings between all components. To minimize the potential for leakage, the soil vapor sampling rate was maintained at less than

200 milliliters per minute using a flow controller supplied by TAMS. Prior to sampling, a shut-in test was performed at each sampling point. A shut-in test allows evaluation of the sample train for potential leaks and is accomplished by opening the canister valve with the well valve still closed. A vacuum was created and then the pump was closed off from the sample train and the initial vacuum pressure recorded. The sample train was considered to pass the leak test when constant vacuum was maintained for 10 minutes.

2.4.2.2 Purging

Prior to collecting a sub-slab sample, the sample train and sub-slab monitoring point were purged using a battery-powered PID to evacuate three well volumes; this procedure is followed so that the vapor samples collected are representative of actual soil vapor concentrations. Purge volumes were calculated based on the dimension specifications of all aboveground gauges, tubing, sampling equipment, and belowground tubing. The volumes of the screen and sand pack were not included in the purge volume calculation because they are assumed to be in equilibrium with soil vapor in the subsurface. Purge volumes and durations were recorded on the vapor sampling field sheets included as Appendix B.

2.4.2.3 Sub-Slab Vapor Sample Collection

Figure 4 presents the sub-slab sampling locations. Sample collection from each of the sub-slab monitoring point commenced immediately after purging and leak testing. Sample train integrity testing was performed using helium, concurrent with sampling, as described above. A vacuum was created to draw the soil vapor to the surface through the tubing and gauges. The vacuum was created using a PID equipped with a battery-powered pump with the sample collection point on the intake side of the pump to prevent any contaminants present in the pump from being drawn into the sample. A two-way valve and "T" fitting were used to isolate the pump from a separate tube connected to the vapor sample canister (Photograph A-29 in Appendix A). To begin sampling, the valve on the canister was opened and the time and initial vacuum were documented. As the canister filled, the pressure gauge on the flow controller was observed to confirm that vacuum in the canister was decreasing over time.

Once the samples were collected, the canister valves were closed and sealed using brass caps supplied by TAMS. Samples were labeled following standard chain-of-custody (CoC) protocols, including noting the final canister vacuums and the serial numbers of all canisters and flow controllers. AECOM documented the sampling activities, such as sampling times and conditions, on the field sheets included in Appendix B. Samples were delivered directly to the analytical laboratory under CoC protocols.

Canister vacuum was noted in the field for each sample and upon receipt at the laboratory to evaluate sample integrity following shipment.

2.4.3 Indoor Air and Ambient Outdoor Air Sample Collection

Refer to Section 2.2.1 and Figures 4 and 5 for indoor sampling locations; the outdoor air sample was collected on the rooftop (Photograph A-19 in Appendix A). The canisters were equipped with flow regulators supplied by TAMS and set to allow a 10-hour sampling period. The outdoor air sample was collected to evaluate the contribution from ambient outdoor air to indoor air. Duplicate samples were collected for IA-1 located next to the former source area and for outdoor air sample OA-1.

2.4.3.1 Indoor Air Sampling Procedure

Each indoor air sample was collected using a 6-liter canister supplied by TAMS. All canisters were individually certified clean by the laboratory (certifications are provided in Appendix D). Each canister was fitted with a vacuum gauge and evacuated by TAMS to a vacuum of at least 26 in Hg. The canisters were fitted with a laboratory-calibrated flow controller to collect an air sample at a constant flow rate over an approximate 10-hour period. The canister vacuums were recorded prior to sampling and at the conclusion of the sampling interval. The canisters used to collect the indoor air samples were placed approximately 4 feet above the floor to provide a sample representative of the breathing zone, with the exception of sample IA-9, which was intentionally placed on the floor next to a floor drain in a restroom. Field data sheets used to record sample times and vacuum pressures are included in Appendix B.

2.4.3.2 Outdoor Air Sampling Procedure

The outdoor air sample and duplicate were collected using certified clean 6-liter Summa® canisters supplied by TAMS. The canisters were fitted with a laboratory supplied vacuum gauge and were received under a vacuum of at least 26 in Hg. The canisters were fitted with a laboratory-calibrated flow controller regulated to collect the sample at a constant flow rate over an approximate 10-hour period. As with the indoor air samples, the canister vacuums were recorded prior to sampling and at the conclusion of the sampling interval.

2.5 Laboratory Analysis

All vapor samples collected from the sub-slab vapor monitoring points were analyzed for VOCs using modified USEPA Method TO-15 and all indoor and outdoor air samples were analyzed for VOCs using TO-15 selective ion monitoring (SIM). The analytes included in the TO-15 SIM analysis were specified in the VI Work Plan Addendum #2 (AECOM 2015a) and include those chemicals identified as COCs in groundwater and additional chemicals identified during previous indoor air sampling events at the building (refer to Table 3).

2.6 Quality Assurance Sampling and Procedures

A total of three sub-slab vapor samples and ten indoor/outdoor air samples were collected. One duplicate sample was obtained for the sub-slab vapor samples at Sub-Slab Sample SS-5. A duplicate sample of indoor air was obtained at Indoor Air Sample IA-1 and a duplicate of outdoor

air was collected at Sample OA-1. Duplicate samples were obtained using a "T" splitter located between the flow controller and two sample canisters (refer to Photograph A-19 in Appendix A).

Samples were labeled following standard CoC protocols, including noting the final canister vacuums and the serial numbers of canisters and flow controllers. AECOM documented sampling activities, including sampling times and conditions, on field sheets (Appendix B). Samples were transported under CoC protocols to TAMS.

Results for all samples, including duplicates, underwent review and validation by an AECOM chemist. All sample collection, laboratory analyses, and data validation were performed according to procedures in the Work Plan Addendum. A Data Validation Memorandum (DVM) is included in Appendix D. The DVM indicates that the sampling data included in this report met the quality objectives for precision, accuracy, representativeness, comparability, and completeness.

3.0 VAPOR INTRUSION PATHWAY EVALUATION AND RISK ANALYSIS

Laboratory analytical results for the December 2015 sub-slab vapor samples are included in Table 5, and results for indoor and outdoor air included in Table 6. Complete laboratory analytical results are included in Appendix C.

3.1 Evaluation and Results

Indoor air VOC concentrations were compared to sub-slab vapor and ambient outdoor air concentrations to determine whether there is sufficient evidence of a complete VI pathway. Sufficient evidence is considered obtained if: 1) a chemical is detected in the sub-slab vapor at least one order of magnitude higher than in the indoor air; 2) indoor air samples contain greater concentrations of VOCs than ambient outdoor air, and 3) the presence of the chemical cannot be explained by site activities or current chemical use.

As part of prior work at the Site, soil vapor screening levels (SVSLs) were derived for sub-slab soil vapor. SVSLs were derived using the USEPA Region 9 RSLs (USEPA 2015a) and DTSC HERO Note 3 screening levels (DTSC 2015) divided by the attenuation factors of 0.03 (for USEPA) and 0.05 (for DTSC). Note that the installation of the passive SVC system effectively increases the attenuation of sub-slab vapors between the building foundation and indoor air by perhaps one to two orders of magnitude, so the screening levels are even more conservative than for a typical site.

The USEPA RSLs and the DTSC HERO Note 3 values that were used as PALs for the indoor air samples are presented in Table 3. RSLs are screening levels derived using equations presented in the RSL Users Guide (USEPA 2015b) that include default reasonable maximum exposure (RME) assumptions for a commercial / industrial scenario with an exposure time of 8 hours per day, exposure frequency of 250 days per year, and exposure duration of 25 years. Based on

these assumptions, the RSLs are the lower of concentrations in air that correspond to a cancer risk of 1×10^{-6} or a hazard quotient (HQ) of 1.

For some chemicals, the DTSC HERO has established screening levels using similar exposure assumptions but more protective toxicity criteria than those used by USEPA to establish the RSLs. For these chemicals the DTSC HERO Note 3 values are considered the PALs. Table 3 also shows accelerated response and urgent response action levels established for commercial/industrial exposures to trichloroethene (TCE) that are not to be exceeded.

3.1.1 Sub-Slab Vapor Results

A total of 13 chemicals were detected in sub-slab vapor in December 2015 (Table 4). These include tetrachloroethene (PCE) and TCE, along with potential breakdown products of these two chemicals. Chloroform was detected, as expected, given its ubiquity at sites supplied with treated city water. Other chemicals were detected at relatively low concentrations and are not considered important from a risk standpoint. Of the 13 chemicals detected, TCE and chloroform are the only chemicals detected above both the USEPA- and DTSC-derived SVSLs. TCE was detected above both the screening levels in all three sub-slab sampling locations (SS-2, SS-5, and SS-10). Sub-slab TCE vapor concentrations were highest in Sub-Slab Sample SS-5, located below Section 1/HAVC Zone 1 of the building. Chloroform was detected above both SVSLs in Sub-Slab Sample SS-5. PCE and cis-1,2-dichloroethene (DCE) were only detected above the DTSC SVSL in Sub-Slab Sample SS-5. Sub-Slab Monitoring Point SS-5 was sampled in both May and December 2015. TCE, PCE, and chloroform concentrations at this location were relatively modest in both May and December 2015 but did show a noticeable increase in December, perhaps related to transient fluctuations in barometric pressure.

3.1.2 Indoor Air and Outdoor Ambient Air Results

Table 6 includes results of indoor air and outdoor air samples with comparison to the USEPA RSLs and the DTSC HERO Note 3 screening levels for commercial / industrial exposure. Outdoor air concentrations are used to evaluate if a background source may be contributing to or may be the source of indoor air concentrations. Outdoor ambient air concentrations were collected at the HVAC intake to the building. A duplicate outdoor air sample was collected and submitted for laboratory analysis. Agreement between the two samples was good, with both having similar detections of VOCs.

Based on the sampling results, no chemicals were detected in indoor air above their respective PAL, with the exception of ethylbenzene (detected at a maximum concentration of 12 microgram per cubic meter [$\mu\text{g}/\text{m}^3$] compared to its PAL of $4.0 \mu\text{g}/\text{m}^3$). The detections of toluene, ethylbenzene, and xylenes were not unexpected given that they are commonly encountered in both outdoor air and indoor air. It also is possible that the recent painting and installation of carpets and other finishing may have contributed to the measured values. If so, however, these concentrations would be expected to rapidly decrease with time.

In general, the concentrations of PCE, TCE and other VI-related compounds of interest were similar in December as in May and/or were low compared to levels considered significant. Therefore, the tenant improvements do not appear to have a measurable effect on the performance of the VI control system.

3.1.3 Risk Results

A screening level risk assessment was conducted using the TCE and PCE results from the indoor air sampling described above. TCE and PCE are the main VI risk drivers based on detected concentration and toxicity. The objective of the screening level human health risk assessment was to assess the potential risks and hazards associated with these chemicals detected in the indoor air using default USEPA RME assumptions for commercial / industrial exposure.

The screening-level risk assessment was conducted in accordance with recommendations included in the RSL User's Guide (USEPA 2015b). The risk-based concentrations considered appropriate to a screening level assessment are those that have been developed for screening purposes and thus incorporate sufficiently health-protective assumptions to offset the uncertainties associated with predicting future lifetime risks.

Several sources of risk-based screening levels are available. The most extensive list of chemicals is provided by the USEPA RSLs (USEPA 2015a). Potential cumulative cancer risks and non-cancer hazard index (HI) for TCE and PCE were calculated on a sample-by-sample basis for each sampling location inside the building.

For carcinogens, the concentration of each individual chemical was divided by its RSL; that ratio was multiplied by 10^{-6} , and resultant risks summed to give an estimate of cumulative risk for the location. For non-carcinogens, the simple ratio of each chemical concentration to its RSL gave the HQ for that chemical; these HQs were summed to give the HI for the VI pathway at that location. TCE and PCE cumulative risk and HIs are listed in Table 7. Using default RME assumptions and USEPA RSLs, the cumulative risk for TCE and PCE detected in indoor air ranged from 1×10^{-7} to 4×10^{-7} and the HI was below 0.1.

4.0 INTERPRETATION, UNCERTAINTIES, AND RECOMMENDATIONS

4.1 Interpretation of Results

The interpretation of calculated cancer risks and non-cancer hazards is part of a process called risk management. USEPA has provided guidance for interpreting these risk results within the CERCLA framework by considering cancer risks less than 1×10^{-6} to be acceptable and non-cancer hazards less than 1 as acceptable. The cumulative risk for all VOCs is below the 1×10^{-6}

risk exposure level and below the HI of 0.1. Therefore, the chemicals detected in indoor air do not present a human health risk under commercial / industrial exposure assumptions.

Building conditions at the time of sampling suggest this sampling event represents a worst-case scenario for VI due to the absence of mechanical ventilation (e.g., HVAC off), which would not be representative of normal working conditions in most occupied buildings.

Uncertainties associated with these site features and assumptions are discussed below.

4.2 Uncertainties

Inherent in the screening level evaluation of potential indoor air risk included in this report are uncertainties associated with the various processes that contribute to the final risk result. Understanding the major uncertainties assists with interpretation of the risk characterization results. In general, the risk assessment process operates in a “cascade” fashion, whereby each phase relies on information generated in the previous phase. If uncertainty is introduced, for example, during the data collection phase, it will be carried through each successive risk assessment phase. When successive uncertainties introduce biases, the final health risk estimates may overestimate or underestimate actual risks and hazards.

4.2.1 Uncertainties Introduced by Sampling Design

The assumptions used in this screening level risk evaluation are intended to approximate actual conditions. However, these conditions are often difficult to represent and entail uncertainties in the choice of specific values to represent many of the parameters used to calculate potential risk. These choices include, but are not limited to, the location of the sampling device, how long to collect air samples, and how often to collect the samples.

Indoor air samples were targeted to be collected over a 10-hour period. This sample duration is representative of an extended work day, but the actual work shift duration of individuals can vary. In general, sampling locations were selected to represent potential occupied spaces throughout the facility.

4.2.2 Uncertainties Introduced by Exposure Assumptions

The exposure assumptions (frequency, time, and duration) used to calculate potential intake rates are another source of uncertainty. For example, the screening risk evaluation used the RME commercial / industrial exposure parameters described in Section 3.1 (8 hours per day, 250 days per year for 25 years); the cumulative RME risk based on an 8-hour work day is below the CERCLA risk management range (10^{-4} to 10^{-6}) while the HI is below 1 for all sections of the building. In actual practice, workers may not be present at various locations for a full 8 hours each workday.

4.2.3 Uncertainties Inherent in Toxicity Values

Uncertainty is also inherent in toxicity values established to evaluate cancer risks and non-cancer HIs. Such uncertainty is chemical-specific and incorporated into the toxicity value during its development. Application of uncertainty factors is expected to overestimate risks. Uncertainties related to the selection of toxicity criteria used to calculate RSLs were minimized by the inclusion of the more protective DTSC HERO Note 3 screening levels in evaluating risk.

4.3 Conclusions and Recommendations

Based on the risk results of this sampling event, chemicals detected in indoor air do not pose a human health risk to current building occupants. These results are based on the current building conditions, and no further sampling is warranted. However, if building conditions change in the future where the sub-slab foundation is affected and/or other VI conduits are created, then an additional monitoring event will be performed utilizing the same sampling methodology and adjusting the sampling location rationale based on the building layout/buildout at the time of sampling.

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MOTION FOR JUDICIAL NOTICE (PART II)
ADDITIONAL EXHIBIT

SECTION:
2019
Five Year Report

FIFTH FIVE-YEAR REVIEW REPORT

FOR

ADVANCED MICRO DEVICES 901/902 AND TRW MICROWAVE

SUPERFUND SITES

INCLUDES THE COMPANIES' OFFSITE OPERABLE UNIT

SANTA CLARA COUNTY, CALIFORNIA



PREPARED BY

U.S. Army Corps of Engineers, Seattle District

FOR

U.S. Environmental Protection Agency

Region IX

Approved by:

Date:

Dina Barten

9/18/19

Dana Barton, Branch Chief

California Site Cleanup and Enforcement Branch

U.S. Environmental Protection Agency, Region 9

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Executive Summary

This is the fifth Five-Year Review (FYR) of the Advanced Micro Devices (AMD) 901/902 Thompson Place Site (AMD Site), the TRW Microwave Superfund Site (TRW Site), and the Companies' Offsite Operable Unit (Offsite OU), located in Sunnyvale, California¹. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment.

The United States Environmental Protection Agency (EPA) issued a Record of Decision (ROD) in 1991 that addressed the AMD Site, the TRW Site and the Offsite OU, as well as the Signetics Site. These three sites and one operable unit have been collectively known by the informal term, "Triple Site".

EPA is the lead agency overseeing environmental investigation and remediation work at the Triple Site. The State of California, San Francisco Bay Regional Water Quality Control Board (Regional Board), was previously the lead agency. On August 7, 2014, EPA Region 9 and the Regional Board agreed to transfer lead agency oversight responsibilities for the Triple Site to EPA Region 9.

This FYR addresses the AMD Site, the TRW Site, and the Offsite OU. The Signetics Site is not addressed in this document because it is not listed on the National Priorities List (NPL), and thus not required by federal Superfund law to be included in the FYR process. However, EPA has been taking steps to establish a broader remedial strategy for regional groundwater restoration through negotiations with Philips Semiconductors, Inc. (Philips), the company responsible for the cleanup for the Signetics Site.

On March 15, 2019, EPA recently entered into an enforcement agreement with Philips which requires the company to perform a Focused Feasibility Study to evaluate options for accelerating the groundwater cleanup at the Signetics Site. The enforcement agreement further requires Philips to assess and mitigate, as necessary, indoor air quality in commercial buildings at the Signetics Site that may be at risk from solvent vapors rising from the contaminated groundwater and accumulating indoors at unacceptable levels (a process called "vapor intrusion").

AMD 901/902 Thompson Place Site

EPA selected the following remedy for the AMD Site in the 1991 ROD: soil excavation; groundwater extraction and treatment; groundwater monitoring; and placement of an environmental covenant prohibiting installation of on-site wells until the completion of groundwater remediation.

Soil excavation at the AMD Site was completed in 1992. A No Further Action letter for the site was then issued by the Regional Board in 2008. The groundwater remedy as described in the 1991 ROD (a groundwater extraction and treatment system [GWETS]) is no longer operating due to declining effectiveness. Portions of the GWETS are now used as part of an in-situ bioremediation (ISB) program to inject and circulate carbohydrate amendment. AMD submitted a draft Focused Feasibility Study to EPA in October 2013 and EPA will amend the remedies once vapor intrusion investigations and Focused Feasibility Studies are complete for AMD, TRW, Signetics and the Offsite OU.

Four contaminants, TCE, cDCE, tDCE, and vinyl chloride, remain at concentrations above groundwater cleanup standards at the AMD Site. Contamination is confined to the shallow groundwater-bearing zones

¹ During cleanup, a site can be divided into a number of distinct areas depending on the complexity of the problems associated with the site. These areas called operable units may address geographic areas of a site, specific site problems, or areas where a specific action is required.

(A, B1, and B2 zones). Remedial efforts have greatly reduced TCE concentrations in the original source areas. Levels of TCE degradation products, cDCE and vinyl chloride, have increased in the ISB treatment areas, indicating that degradation is occurring but that it is incomplete. Contamination from off-site, upgradient sources, including the Signetics Site, continues to occur.

There have been no changes to the Applicable, Relevant and Appropriate Requirements (ARARs) which groundwater cleanup goals were based on. Land use has not changed since the last FYR. Exposure pathways from soil and groundwater are being controlled. An environmental covenant was recorded in 2005 for the AMD Site that prohibits residential land use, groundwater well installation, and soil excavation but the Regional Board was not a signatory to the covenant.

EPA evaluated vapor intrusion in 2014; results indicate that potential indoor air exposures due to groundwater contamination at the AMD Site are not a concern under the current commercial land use.

The remedy at the AMD Site currently protects human health and the environment because exposure pathways for soil and groundwater are being controlled and there is no evidence of unacceptable vapor intrusion for the current commercial land use. However, in order for the remedy to be protective in the long-term, a revised final groundwater remedy for the AMD Site should be selected, as the remedy selected in the 1991 ROD is no longer operating. The revised remedy should also address potential vapor intrusion in the event of future land use changes, as vapor intrusion was not addressed in the 1991 ROD and record a new environmental covenant that includes the Water Board as a signatory.

TRW Microwave Site

In the 1991 ROD, EPA selected the following remedy for the TRW Site: groundwater extraction; treatment of extracted groundwater by air stripping; groundwater monitoring; discharge of treated water under a National Pollutant Discharge Elimination System (NPDES) permit; and institutional controls, including restrictive and environmental covenant, which include prohibiting residential land use and extraction of groundwater.

A GWETS operated at the TRW Site between 1986 and 2001. Between 1993 and 1998, a soil vapor extraction and treatment system was also used to facilitate cleanup of residual contamination. Due to declining effectiveness, the GWETS was discontinued in 2001. Northrup Grumman, the company conducting the TRW cleanup, subsequently proposed to study enhanced anaerobic biodegradation (EAB) as a possible remedy for groundwater. Pilot testing for EAB began in 2000 and was expanded in 2005. EAB has achieved some success in reducing chemical contaminants concentrations, although rebound has been observed. A draft Focused Feasibility Study was completed in 2011 and is currently being revised. Recent site investigation data were incorporated into an updated Conceptual Site Model that identified various preferred contaminant migration pathways in the aquifers.

Overall, remedial efforts have substantially reduced chemical contaminant concentrations in the source area and in the aquifer A, B1, and B2 zones since implementation of the remedy. Achievement of cleanup goals will remain a challenge as long as the migration of chemical contaminants from upgradient sources, including the Signetics Site, continues to occur.

TRW conducted an initial vapor intrusion evaluation at the TRW Site which indicated that TCE concentrations in indoor air near the former source area present an inhalation risk, exceeding the applicable commercial screening levels. Mitigation efforts (installation of a sub-slab passive venting system, with the capability of being converted to an active system as necessary) were completed in 2015. Confirmatory indoor air sampling following the completion of the mitigation activities showed levels of

chemical contaminants below levels considered safe, confirming the success of the mitigation measures in addressing the inhalation risk.

There have been no changes to the ARARs which groundwater cleanup goals were based on since the ROD was issued. Land use has not changed since the last FYR. Exposure pathways for soil and groundwater are being controlled. A covenant and agreement that prohibits use of groundwater, excavation of soils and prohibits land use for was recorded in 1992.

The remedy at the TRW Site currently protects human health and the environment because exposure pathways for soil and groundwater are being controlled. Exposure pathways to contaminated groundwater that could result in unacceptable risks are addressed in an environmental covenant. The risk due to vapor intrusion for the current commercial land use has been addressed. However, in order for the remedy to be protective in the long-term, a revised soil and groundwater remedy for the TRW Site should be selected, as the remedy selected in the ROD is no longer operating. The revised remedy should also address vapor intrusion assessment and response procedures to ensure the long-term stewardship of the vapor intrusion mitigation measures currently in place, as well as potential vapor intrusion in the event of future land use changes, as vapor intrusion was not addressed in the 1991 ROD.

Offsite Operable Unit

The Offsite OU extends north from the Signetics Site and encompasses an area of about 100 acres. The area includes four schools and more than 100 residences. Groundwater contamination in the Offsite OU is due to commingled, upgradient sources, including the Signetics, AMD and TRW Sites.

In the 1991 ROD, EPA selected expanded groundwater extraction; treatment of extracted groundwater by air stripping; and reuse or discharge of the treated groundwater to surface water under an NPDES permit. EPA estimated that the groundwater in the Offsite OU would be restored in 36 years.

Generally, the remedy appears to be containing contaminants migrating from upgradient sources and preventing further downgradient migration. The concentration footprint of the plume has not significantly changed within the review period indicating containment is occurring. Groundwater restoration within the Offsite OU did not progress substantially and is not expected to be achieved in a reasonable timeframe. The current understanding of the subsurface is simplified and does not account for the potential for highly channelized flow. A remedy optimization, and possibly a new remedy, is needed in order to restore the aquifer in a reasonable timeframe.

There have been no changes to the ARARs which groundwater cleanup goals were based on since the 1991 ROD. Land use is primarily residential. Institutional controls are in place to prevent well installation in Santa Clara County, and a municipal water supply exists for the area (Hetch Hetchy Reservoir in the Sierra Nevada Mountains).

A vapor intrusion assessment in the Offsite OU began in 2015 and is ongoing. To date, more than 225 households and 40 school buildings have been sampled and more than 20 mitigation systems have been installed in residential and school buildings to address findings of unacceptable vapor intrusion [i.e., indoor air TCE levels due to vapor intrusion exceeding the short-term screening level of 2.0 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)]. Mitigation efforts have largely consisted of installation of sub-slab or sub-membrane depressurization systems, ventilation upgrades, conduit sealing, installation and operation of indoor air purifiers, Operations & Maintenance (O&M) measures, and post-mitigation confirmatory indoor air sampling to confirm success of mitigation measures at achieving protective levels of TCE.

Sampling of ambient outdoor air has occurred regularly in the Offsite OU since January 2015, in conjunction with indoor air sampling events in residences and schools. While outdoor air TCE levels have often been low, periodic spikes have been observed of up to 3.6 $\mu\text{g}/\text{m}^3$, with a general upward trend in these spikes over time. To be protective in the long-term, an investigation into the contributions to outdoor air TCE levels from fugitive emissions from the groundwater treatment system and emissions from the vapor intrusion mitigation system vent stacks should be conducted.

The remedy for the Offsite OU currently protects human health and the environment because exposure pathways for soil and groundwater are being controlled. The risk due to vapor intrusion for the current residential use is being addressed through installation of mitigation measures. However, in order for the remedy to be protective in the long-term, a remedy performance optimization and updated site conceptual model is needed. A revised remedy may be needed to achieve the RAOs and to address vapor intrusion assessment and response procedures to ensure the long-term stewardship of the vapor intrusion mitigation measures currently in place. Finally, an investigation of the contributions to outdoor air TCE levels from fugitive emissions from the groundwater treatment system and emissions from the vapor intrusion mitigation systems is needed.

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List of Abbreviations

1,1-DCA	1,1-dichloroethane
1,2-DCB	1,2-dichlorobenzene
1,1-DCE	1,1-dichloroethylene
1,1,1-TCA	1,1,1-trichloroethane
AOC	Administrative Order on Consent
AMD	Advanced Micro Devices
ARAR	applicable or relevant and appropriate requirements
cDCE	cis-1,2-dichloroethylene
DNAPL	Dense non-aqueous phase liquid
EAB	enhanced anaerobic biodegradation
EPA	Environmental Protection Agency
FFS	Focused Feasibility Study
FYR	Five-Year Review
GWETS	groundwater extraction and treatment system
HRC	hydrogen release compound
HVAC	heating and ventilation systems
ISB	in-situ bioremediation
MCL	maximum contaminant limit
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	operable unit
PCE	tetrachloroethylene
PRP	potentially responsible party
RAO	remedial action objectives
ROD	Record of Decision
RP	Responsible Party
RSL	regional screening level
SCVWD	Santa Clara Valley Water District
TCE	trichloroethylene
tDCE	trans-1,2-dichloroethylene
USACE	United States Army Corps of Engineers
UST	underground storage tank
UV	ultraviolet
VOC	volatile organic compounds

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, 40 Code of Federal Regulation Section 300.430(f)(4)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and EPA policy.

This is the fifth FYR for the Advanced Micro Devices (AMD) 901/902 Thompson Place Site (AMD Site), TRW Microwave Superfund sites (TRW Site), and the Companies' Offsite Operable Unit (Offsite OU). The triggering action for this statutory review is the completion of the previous FYR on September 30, 2013. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the AMD Site, TRW Site, and Offsite OU above levels that allow for unlimited use and unrestricted exposure.

The FYR was led by Melanie Morash, EPA, Remedial Project Manager. Participants included Rebecca Rule, U.S. Army Corps of Engineers (USACE), Project Manager; Jacob Williams, USACE, Chemist; and Kris Addis, USACE, Geologist. The review began on October 1, 2018.

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Advanced Micro Devices 901/902 and TRW Microwave Superfund Sites		
EPA ID: CAD048634059 (AMD) and CAD009159088 (TRW)		
Region: 9	State: CA	City/County: Sunnyvale, Santa Clara County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Melanie Morash		
Author affiliation: USEPA Region 9		
Review period: 10/1/2018 – 7/1/2019		
Date of site inspection: 3/14/2019		
Type of review: Statutory		
Review number: 5		
Triggering action date: 9/30/2014		
Due date (five years after triggering action date): 9/30/2019		

1.1. Background

The AMD site, TRW site, and Offsite OU are clustered together on relatively flat land south of San Francisco Bay in Sunnyvale, California. The sites and operable unit (OU) reviewed for this FYR are the AMD Site, TRW Site, and Offsite OU. Together with an adjacent site – the Signetics Site– these three Sites and one OU are collectively known by the informal term, “Triple Site.”

The Signetics Site is not addressed in this document because it is not listed on the National Priorities List (NPL), and thus not required by federal Superfund law to be included in the FYR process. The Signetics Site was proposed for listing on the NPL but was ultimately not listed because it was being regulated under a different federal program, the state-authorized Resource Conservation and Recovery Act program. The AMD 915 DeGuigne Drive Superfund Site is addressed under a separate ROD and is not addressed in this FYR (being addressed under a separate FYR).

AMD 901/902 Thompson Place Site

The AMD site boundary, as defined in the ROD, includes the location of two former large, low-rise industrial buildings connected by a hallway (formerly 901 and 902 Thompson Place) and extends east to DeGuigne Drive. As defined, the AMD site includes seven other commercial buildings; however, these seven buildings do not overlie groundwater impacted by former AMD operations.

AMD manufactured printed circuit boards and semiconductors continuously at the AMD Site between 1969 and 1992. During this time, AMD used trichloroethylene (TCE) and other industrial solvents for cleaning and degreasing, although TCE use reportedly ceased around 1979. Acids were used for etching, and caustics were used for acid neutralization. Acid neutralization systems, including in-ground sumps, were used at both AMD buildings between 1969 and 1984. Related hazardous wastes generated from these various operations were stored on-site.

In 1982, leakage from an acid neutralization sump at the former 901 Thompson Place building initiated site investigations. The sump in the former 902 Thompson Place building was subsequently found to also be leaking. Additional studies of groundwater contamination in the 1980s identified chlorinated volatile organic compounds (VOCs), primarily TCE and its biodegradation products, cis-1,2-dichloroethylene (cDCE) and vinyl chloride, in the upper 65 feet of soil under the AMD Site. The maximum historical TCE concentration found in groundwater was 110,000 micrograms per liter (µg/L) at well 28-S, located near the neutralization tank adjacent to the former 902 Thompson Place building.

TRW Microwave Site

The former TRW Microwave site is located to the north of the AMD Site, also in a topographically flat area of the Santa Clara Valley. The on-site building has been vacant since January 2001. Between 2001 and 2003, a portion of the building was demolished and a new structure, contiguous with the remaining portion of the existing building, was constructed.

TRW assembled and tested microwave and semiconductor components at the TRW Site between 1968 and 1993. TRW used TCE and several other industrial solvents and hazardous compounds; hazardous wastes were generated as a by-product of the operations. TRW stored waste solvents (mostly TCE) in an

underground storage tank from 1970 through 1982. The tank was removed in early 1983. An in-ground, three-stage, ammonia gas acid neutralization system also operated from 1968 to 1984, when it was disconnected and removed. It was replaced by an aboveground system with secondary containment. The aboveground acid neutralization system was disconnected and removed in 2001, during remodeling of the site building.

TRW initiated an investigation of potential impacts to soil and groundwater at the TRW Site following the removal of the underground storage tank. Between 1983 and 1986, several subsurface investigations were conducted in the vicinity of the former areas of the underground storage tank, the acid neutralization systems, and associated piping. The investigations identified VOCs as the only contaminants of concern at the TRW Site, and the former underground storage tank area as the only source of VOCs impacting groundwater at the TRW Site.

Offsite Operable Unit

The Offsite OU extends north from the AMD and TRW Sites and represents the largest OU in spatial extent. The Offsite OU was originally mapped to encompass a single commingled groundwater contaminant plume composed primarily of dissolved trichloroethylene (TCE).

In the 1980s, investigations began in the groundwater north of Duane Avenue to provide information on the vertical and horizontal extent of contamination in the Offsite OU. Contaminants were discovered in groundwater but were not observed in the soil in the Offsite OU. Due to the lack of potential sources in the Offsite OU, the sources for the observed contaminant concentrations were attributed to AMD, TRW and Signetics sites located up-gradient of the area. A commingled plume of contaminated groundwater, approximately 4,000 feet long, underlies the land in the Offsite OU and extends beyond Highway 101 to the north. Chemical contaminants in the groundwater plume are primarily chlorinated VOCs, predominantly TCE.

The Offsite OU encompasses an area of about 100 acres. The area includes four schools and more than 100 residential buildings. The schools include a daycare/preschool, two elementary schools, and one middle/high school. Concentrations of chemical contaminants in groundwater beneath many of the residences and some schools have yet to be determined.

Related Site– Signetics Site

On August 7, 2014, EPA Region 9 and the State of California, San Francisco Bay Regional Water Quality Control Board (Regional Board), agreed to transfer lead agency oversight responsibilities for the Triple Site, including the Signetics Site, from the Regional Board to EPA Region 9. EPA recently entered into an enforcement agreement with Philips Semiconductors, Inc. (Philips) for the Signetics Site, which requires the company to conduct a focused feasibility study to evaluate options for accelerating the groundwater cleanup at the Signetics Site. The enforcement agreement further requires Philips to assess and mitigate, as necessary, indoor air quality in commercial buildings at the Signetics Site that may be at risk from solvent vapors rising from the contaminated groundwater and accumulating indoors at unacceptable levels (a process called “vapor intrusion”).

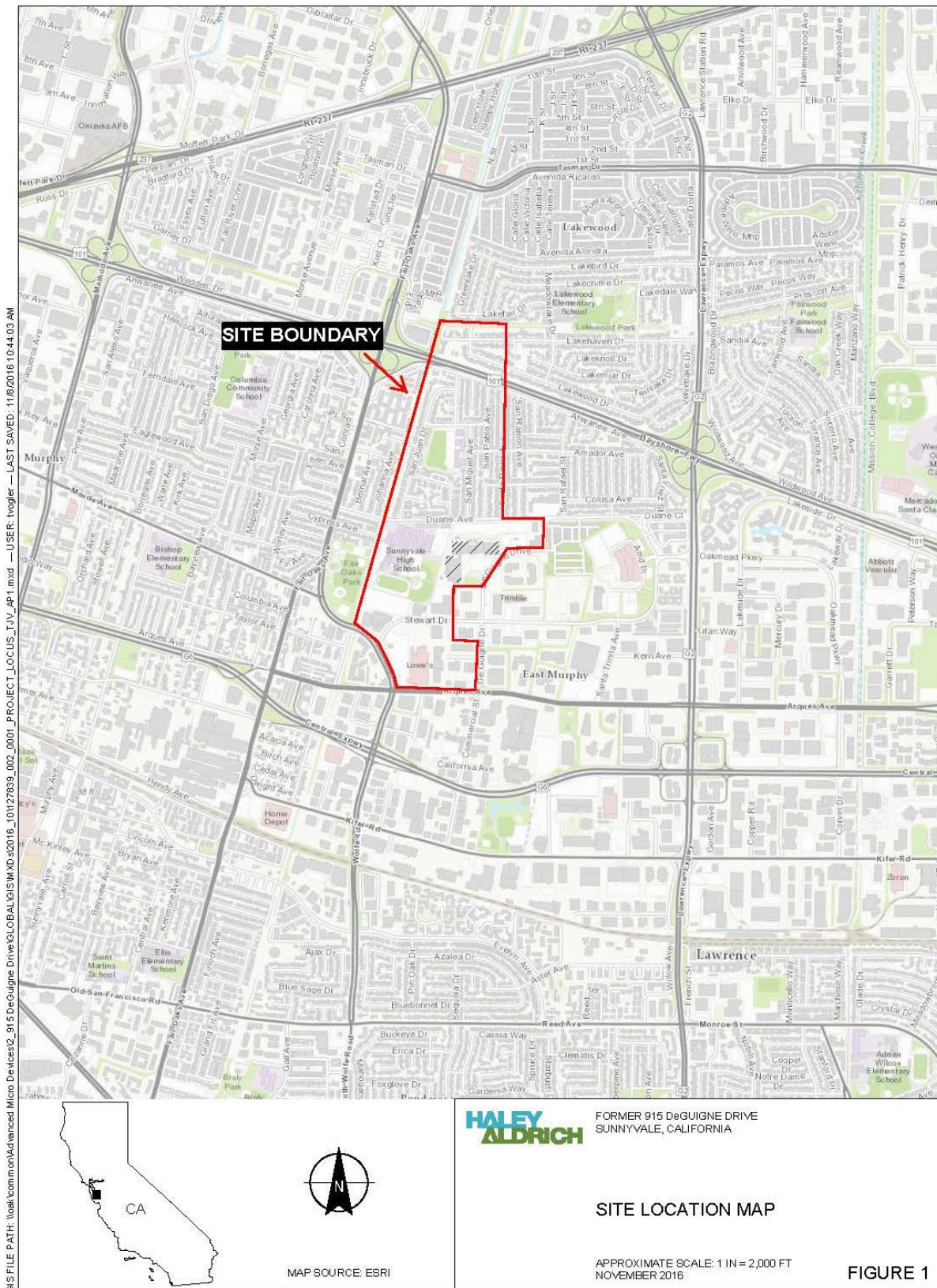


Figure 1. Location Map for the AMD 901/902 and TRW Superfund Sites and Offsite OU



1.2. *Physical Characteristics*

AMD 901/902 Thompson Place Site

Prior to the late 1960s, land use in Santa Clara County was agricultural, predominantly commercial fruit orchards. Industrial operations began at the AMD Site in 1969 when AMD began manufacturing printed circuit boards and semiconductors at 901 Thompson Place. AMD began operations at the former 902 Thompson Place building in 1972, operating the combined facility until 1992. Operations were continuous with no significant process changes until 1992.

AMD discontinued operations and vacated the two buildings in 1992. The AMD Site was sold to Westcore Thompson II, LLC in 2005; the AMD Site was later transferred to Summit Commercial Properties, Inc. Summit demolished the two buildings in 2006 and built the existing self-storage warehouse in 2007. The address was also changed from 901/902 Thompson Place to 875 East Arques Avenue at that time.

The AMD Site boundary, as defined in the ROD, includes the location of the two former low-rise industrial buildings connected by a hallway (formerly 901 and 902 Thompson Place) and extends east to DeGuigne Drive (Figure 2). As defined, the AMD Site includes seven other commercial buildings; however, these seven buildings do not overlie groundwater impacted by former AMD operations. Groundwater impacted by VOCs beneath these buildings appears to be attributable to off-site, up-gradient sources. A self-storage warehouse built in 2007 currently occupies the former footprint of the 901 and 902 Thompson Place buildings. The area immediately surrounding the property is a mix of light commercial use and residential properties.

TRW Microwave Site

Industrial operations began at the TRW Site in 1968, when Aertech Industries began assembling and testing microwave and semiconductor components. In 1974, TRW acquired the site from Aertech and continued similar operations. In 1987, FEI Microwave purchased the site from TRW; FEI Microwave subsequently became Tech Facility 1, Inc. FEI Microwave operated the facility until 1993. Operations were continuous with no significant process changes between 1968 and 1993. In 1995 the TRW Site was acquired by Stewart Associates and subsequently leased to Diablo Research Corporation and Cadence Inc. for research and development operations.

In 2002, TRW merged with Northrop Grumman Systems Corporation (Northrop Grumman). In 2004, the property was purchased by Pacific Landmark. The property ownership changed again in May 2014 to Hines. During these changes in ownership of the TRW Site, TRW, and then Northrop Grumman, retained responsibility for the site cleanup. The building is currently occupied and is zoned for light industrial use. The area immediately surrounding the property is light commercial with a mix of residential properties.

Offsite Operable Unit

The Offsite Operable Unit (Offsite OU or OOU) is primarily a residential neighborhood consisting of single-family and multi-family homes and includes 4 schools. The Offsite OU does not contain any buildings or properties from which the former Companies (AMD, TRW, and Philips/Signetics) caused soil and groundwater contamination through their industrial operations. Directly to the north and down-

gradient of the AMD, TRW, and Philips OUs is the former high school for the City of Sunnyvale, which was used until the early 1980s. Subsequently, the school was leased for a number of years to house an engineering center. Currently, the buildings at the 790 East Duane Avenue property are occupied by the daycare/elementary school. Adjacent to this property are a preschool and daycare and a high school, and within the approximate center of the Offsite OU is an elementary school.

1.3. Hydrology

The AMD and TRW sites and the Offsite OU are located in the Santa Clara Valley, a structural basin bounded by the Santa Cruz Mountain to the south and west, and the Diablo Range to the north. The sites are underlain by alluvial sequences eroded from the Santa Cruz Mountains and deposited in the basin in north-trending streams en route to San Francisco Bay. The depositional environment is characterized by meandering and braided stream systems that created sequences of coarse-grained units interbedded with fine-grained clay and silt.

The alluvial sediments at the sites are divided into two hydrogeologic zones referred to as the Upper Aquifer and the Lower Aquifer. These two zones are separated by a relatively impermeable aquitard at approximately 120 feet below ground surface. The Lower Aquifer, an extensive, deep, regional, confined aquifer, lies underneath the aquitard. Municipalities utilize some wells within this deep regional aquifer for drinking water. However, the Santa Clara Valley Water District supplies drinking water for this part of Sunnyvale from the Hetch Hetchy Reservoir in the Sierra Nevada Mountains, and tests the supply to ensure that all state and Federal drinking water standards are met.

Regional Designation	Local Zone Designation	Approximate depth below ground surface (ft)	HSU Identified
Upper Aquifer	A		
		20	
	B1		TRW HSU 1-3
		40	
	B2		
		60	
	B3		
		80	
	B4		
		100	
	B5		
Regional Aquitard	B-C Aquitard	120	
Lower Aquifer	C Aquifer	300	
		500	

Note: Hydrostratigraphic units (HSU) consist of very permeable coarse-grained material inferred to be relic channel deposits that generally trend north/south. These channel deposits are surrounded by low-permeability silts and clay inferred to be overbank stream deposits. The channel deposits provide preferred pathways for contaminant migration hydraulically downgradient from the source area.

Figure 3. Aquifer designations with associated water bearing zones and Hydrostratigraphic Units.

The Upper Aquifer is divided into six water-bearing zones, Zone A, and Zones B1 through B5 (Figure 3). The Upper Aquifer consists of transmissive sand and gravel units vertically and laterally separated by low permeability units of silt and/or clay. Groundwater flow direction for all upper zones is generally to the north, toward San Francisco Bay. Groundwater extraction wells within the Upper Aquifer in the Offsite OU and at the adjacent Signetics and AMD 915 sites impact local groundwater direction and gradient.

The water-bearing zones appear to be laterally continuous throughout the AMD and TRW sites and Offsite OU, and range from silty sand to sand and gravel. Recent studies identified several higher

permeable units within a single water-bearing zone. Each zone has a heterogeneous composition, and contains lenses that are highly discontinuous and more permeable than surrounding soil.

Northrup Grumman, the company responsible for the TRW Site, updated their Conceptual Site Model and detailed the depositional environment of alluvial deposits in the Triple Site area². Numerous hydrostratigraphic units (HSU) were identified within A, B1, and B2 Zones. These hydrostratigraphic units have not been projected or identified to any significant extent beyond the TRW Site. Permeable channel deposits representing hydrostratigraphic unit preferred pathways have been identified in the A and B1 Zones at the Signetics Site.

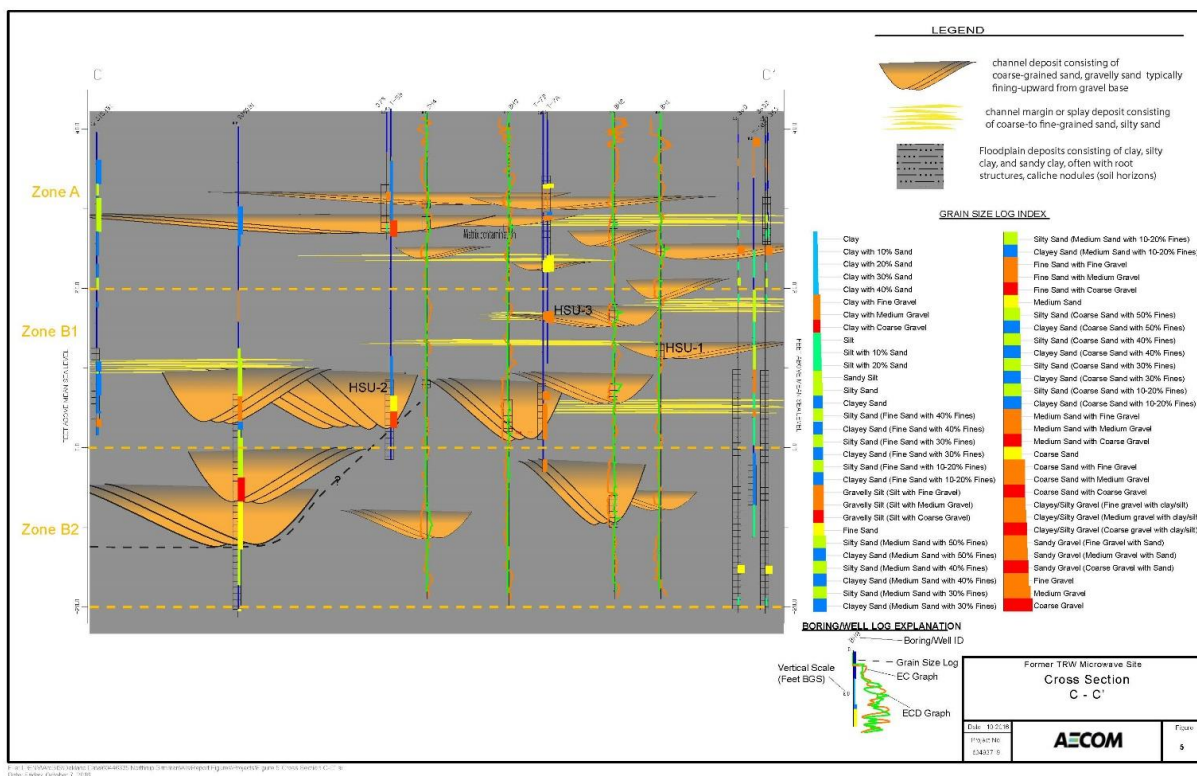


Figure 4. Cross-Section Showing hydrostratigraphic units in the A, B1, and B2, Zones Beneath the TRW Site

² A Conceptual Site Model is comprehensive graphical and written summary of what is known or hypothesized about environmental contamination at a site. It provides a platform for evaluating the data gaps and related uncertainty associated with site history and operations; geology, hydrogeology and hydrology; contaminant sources, release mechanisms and fate and transport; potential receptors and exposure pathways.

2. Remedial Actions Summary

2.1. Basis for Taking Action

The presence of chlorinated VOCs in soil at the AMD and TRW sites and in groundwater at the AMD and TRW sites and Offsite OU provided the basis for taking action. The release of hazardous substances into the environment at the sites posed, or potentially posed, a threat to human health and the environment via inhalation, ingestion, and direct contact.

2.2. Remedy Selection

The combined ROD for the AMD, TRW, Signetics, and Offsite OU was signed on September 11, 1991.

The remedial action objectives (RAOs) selected are:

- Prevention of the near-term and future exposure of human receptors to contaminated groundwater and soil;
- Restoration of the contaminated groundwater for future use as a potential source of drinking water;
- Control of contaminant migration; and
- Monitoring of contaminant concentrations in groundwater to observe the control of contaminant migration and the progress of cleanup.

The ROD estimated that the restoration of groundwater at the TRW Site would occur in seven years; at the AMD 901/902 Site would occur in 18 years; and at the Offsite OU would be achieved in 36 years. Volatilization of groundwater contaminants from the subsurface was not considered for AMD 901/902, TRW or Signetics because there were no residential properties at the time of the ROD. The ROD identified the potential for vapor intrusion for the Offsite OU, but deferred evaluation of the risk for further Five-Year Reviews because at the time of the ROD, the understanding of vapor intrusion was unclear.

The ROD selected state Maximum Contaminant Levels (MCLs) for groundwater cleanup standards for nine of the ten chemical contaminants (Table 2). Due to the lack of a state MCL for 1,2-dichlorobenzene (1,2-DCB), the cleanup level was set at the Federal MCL. No soil cleanup levels were selected in the ROD for the AMD Site, the TRW Site, or the Offsite OU.

Table 2. Groundwater Cleanup Standards

Chemical	Cleanup Standard (µg/L)	Source	Applicable Sites and Offsite OU
1,1-DCA	5	CA MCL	AMD 901/902, TRW, Offsite
1,2-DCB	600	Federal MCL	AMD 901/902, TRW
cDCE	6	CA MCL	AMD 901/902, TRW, Offsite
Trans-1,2-DCE	10	CA MCL	AMD 901/902, TRW, Offsite
1,1-DCE	6	CA MCL	AMD 901/902, TRW, Offsite
Freon 113	1200	CA MCL	AMD 901/902, TRW, Offsite

Chemical	Cleanup Standard (µg/L)	Source	Applicable Sites and Offsite OU
PCE	5	CA MCL	AMD 901/902, TRW, Offsite
TCE	5	CA MCL	AMD 901/902, TRW, Offsite
1,1,1-TCA	200	CA MCL	AMD 901/902, TRW, Offsite
Vinyl Chloride	0.5	CA MCL	AMD 901/902, TRW

AMD 901/902 Thompson Place Site

The remedy selected in the ROD for the AMD 901/902 Site consists of the following elements:

- Soil excavation followed by off-site incineration/disposal of the remaining contaminated soil beneath the AMD 901/902 Site;
- Continued groundwater extraction and treatment by air stripping;
- Groundwater monitoring; and
- Placement of a restrictive covenant prohibiting installation of on-site wells until groundwater remediation is completed.

TRW Microwave Site

The remedy selected in the ROD for the TRW Site consists of the following elements:

- Groundwater extraction;
- Treatment of extracted groundwater by air stripping;
- Discharge of treated water under a National Pollutant Discharge Elimination System (NPDES) permit; and
- Institutional Controls, including restrictive and environmental covenants, which include prohibition of residential land use, prohibition of groundwater extraction, and continued groundwater monitoring.

Offsite OU

The remedy selected in the ROD for the Offsite OU consists of the following elements:

- Expanded groundwater extraction;
- Treatment of extracted groundwater by air stripping (at the time at the nearby AMD 915 Site, since relocated to the Signetics Site at 813 Stewart Drive); and
- Reuse or discharge of the treated groundwater to surface water under a NPDES permit.

2.3. *Remedy Implementation*

AMD 901/902 Thompson Place Site

In response to the 1991 Site Cleanup Requirements and ROD, an additional 94 cubic yards of soil were excavated from the AMD Site in 1992. The contaminated soil was disposed of off-site, and the remaining uncontaminated soil was used as backfill. The Regional Board reviewed the relevant soil and groundwater sampling results for VOCs and issued a No Further Action letter, dated May 14, 2008, to confirm completion of site investigation and remedial actions for releases with respect to unsaturated zone (shallow) soil at the AMD Site. Foundation demolition work occurred at the AMD Site on July 27, 2016, and residual impacted soil was encountered during deep earthwork. Approximately 580 cubic yards of soil were excavated and disposed of off-site.

Groundwater remediation is still ongoing at the AMD Site. The groundwater extraction and treatment system (GWETS) began operation in 1983 with three extraction wells, was expanded to a total of eight extraction wells in 1993 (wells DW-1 through DW-8), and continued operation through 2002. The GWETS pumped water from the A, B1, and B2 zones to an on-site treatment system where VOCs were removed from the extracted water by air-stripping. Treated water was discharged under a NPDES permit to the storm sewer or put to reuse on-site.

Although concentrations of chemical contaminants associated with on-site releases decreased as a result of the GWETS operation, the rate of chemical contaminant concentration reduction was marginal. Because of the declining effectiveness of the selected remedy, in-situ bioremediation (ISB) was tested to accelerate the groundwater cleanup. Pilot testing for ISB began in 2002, and full-scale ISB commenced in 2005. During the pilot study, in which carbohydrate was injected into the groundwater to stimulate microbial processes, TCE, cDCE, and vinyl chloride concentrations were reduced in pilot test wells by over 90 percent within six months.

Following the successful demonstration of the ISB pilot test, AMD expanded the ISB program and integrated the GWETS to assist circulation. Use of the GWETS as a groundwater circulation tool was shown to be effective in distributing carbohydrate throughout the treatment zone. ISB activities are currently ongoing.

An environmental covenant prohibiting residential land use, groundwater well installation, and soil excavation was recorded for the AMD Site in 2005.

In September 2013, a revised Focused Feasibility Study (FFS) was completed that evaluated groundwater extraction and treatment, ISB, monitored natural attenuation, and a permeable reactive barrier as potential revised remedies for the site.

TRW Microwave Site

Interim actions at the TRW Site began in 1983 with the removal of the waste solvent Underground Storage Tank and associated contaminated soil. Additional soil, ultimately totaling 120 cubic yards, was removed from this area in 1984. Due to the proximity of the excavation to the foundation of the 825 Stewart Building, not all of the contaminated soil could be removed.

The GWETS and groundwater monitoring program at the TRW Site were fully implemented at the time the final Site cleanup Requirements and ROD were adopted in 1991.

Following the signing of the ROD in 1991, TRW began soil vapor extraction and treatment in July 1993 to enhance cleanup in the unsaturated zone in the vicinity of the former underground storage tank area. The soil vapor extraction and treatment system operated full-time through November 1996 and removed approximately 140 pounds of TCE. The system was removed in November 1998 and the Regional Board issued a letter stating that no further action was required in the vadose zone.

Decreases in TCE groundwater concentrations were most dramatic during the first five years of GWETS operation (1985 to 1990). During the 1990s, TCE concentrations appeared to have reached near asymptotic levels. In 1998, TRW concluded that the GWETS had reached its limit of effectiveness, due to the limited ability of the GWETS to flush out chemical contaminants in the silty/clayey zones of the aquifer system. In 2000, the TCE mass removed was only 30 percent of that removed in 1985, and in 2001, the Regional Board approved permanent suspension of groundwater extraction.

The GWETS was shut down in the source area in October 2000 to allow an enhanced anaerobic biodegradation (EAB) treatability study, to address high concentrations of chemical contaminants in groundwater near the on-site source area outside of the excavation. Complete GWETS shutdown occurred in April 2001 with the approval of the Regional Board. At the request of the current property owner, the above-ground GWETS components were dismantled and removed in November 2012. The eight wells originally designed for use in the GWETS remain in use for groundwater monitoring and are part of a 47-well on-site monitoring well network.

The EAB treatment utilized an injection of Hydrogen Release Compound into source area B1 zone wells. A follow-up injection into A zone and additional B1 zone wells occurred in June 2001. Following a successful pilot program, the EAB program was expanded in 2005 to include the area immediately down-gradient of the former source area. Between 2007 and 2008, emulsified vegetable oil and neat vegetable oil were injected into source area wells to generate reducing conditions and to sequester chlorinated VOCs within the neat oil introduced into the pea gravel-filled excavation. Following the injections, two additional carbon substrates, were injected down-gradient of the former site source area in November 2011.

In October and November 2014, an opportunity arose to excavate additional contaminated soils from the source area during property redevelopment. A targeted excavation was conducted, during which approximately 590 tons of soil and semi-solids were removed from the source area.

Extraction wells are generally installed near the down-gradient site boundary to reduce the potential to impact down-gradient properties. Injection wells are generally installed up-gradient of the former chemical contaminant source area. Annual groundwater monitoring and EAB activities continue at the TRW Site.

A draft Focused Feasibility Study was completed in 2011 that evaluated several remedies, including groundwater extraction and treatment, EAB, institutional controls, monitored natural attenuation, and in-situ chemical oxidation. This Focused Feasibility Study is currently being updated by Northrup Grumman

to reflect additional data and findings from investigative and remedial work that has occurred at the TRW Site subsequent to 2011.

Offsite OU

Twenty-nine extraction wells are operating within the Offsite OU. The wells are clustered into four parallel groups, based on location. From south to north, the well groupings are Duane Avenue, Carmel Avenue, Alvarado Avenue, and Ahwanee Drive. The Duane Avenue extraction well cluster includes nine extraction wells with at least one well in each of the Upper Aquifer A, B1, B2, B3, and B4 zones. This portion of the GWETS began pumping in November 1986. To the north of the Duane Avenue group lies the Carmel Avenue subsystem, which was installed in 1988 and augmented in 1992. The Carmel Avenue group includes five wells distributed among the A, B1, and B2 zones. The Alvarado Avenue subsystem consists of 10 wells across the A, B1, and B2 zones. These wells were installed in 1988 and 1992. The fourth and northernmost line of extraction wells lies along Ahwanee Drive and consists of five wells in the A, B1, and B2 zones. These wells were also installed in 1988 and 1992.

Until October 2010, groundwater from all the Offsite OU extraction wells was conveyed to a treatment system located on the northern side of the building at the nearby AMD 915 Site. The influent groundwater at this facility was first treated using two packed tower air stripper units plumbed in parallel. In October 2010, groundwater extracted from the Offsite OU was permanently diverted to the treatment system at the Signetics Site at 813 Stewart Drive. This treatment system also treats groundwater extracted from the Signetics Site.

The treatment system at the Signetics Site uses an ultraviolet oxidation system as the primary treatment method. The system is sized to remove 100 percent of the influent concentrations of Signetics site chemical contaminants. The ultraviolet oxidation system is also partially effective for Freon 113. A secondary treatment process of air stripping follows the ultraviolet oxidation system. The exhaust from the air stripper is vented to the atmosphere. After these two processes, the treated effluent is discharged to the Sunnyvale East Drainage Channel in accordance with NPDES Permit.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statements from the 2014 FYR for the AMD and TRW sites stated the following:

The remedy at the AMD 901/902 OU currently protects human health and the environment by controlling exposure pathways that could result in unacceptable risks. However, in order for the remedy to be protective in the long-term, the ROD will need to be amended to reflect a revised final groundwater remedy for the Site since the remedy selected in the ROD is no longer operating.

The remedy at the TRW OU currently protects human health and the environment because exposure pathways for soil and groundwater are being controlled. Exposure pathways to contaminated groundwater that could result in unacceptable risks are prevented through an

environmental covenant. The risk due to vapor intrusion is controlled as long as the building remains unoccupied and the exposure pathway remains incomplete. However, in order for the remedy to be protective in the long-term, the ROD will need to be amended to reflect a revised final soil and groundwater remedy for the Site since the remedy selected in the ROD is no longer operating.

A protectiveness determination of the remedy at the Offsite OU cannot be made at this time until further information is obtained. Vapor intrusion assessments must be conducted to determine if indoor air pathways are complete. If unacceptable levels are encountered in a particular building, mitigation plans will be implemented to ensure that levels of VOCs in indoor air are protective. EPA has begun a vapor intrusion assessment and expects that these activities will take approximately two years to complete, at which time a protectiveness determination can be made.

The 2014 FYR included five issues and recommendations.

Table 3. Status of Recommendations from the 2014 FYR

OU	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
AMD 901/902	The remedy selected for the Site is no longer being operated.	Select a revised cleanup plan and prepare a revised EPA decision document.	Ongoing	A revised Focused Feasibility Study was submitted in 2013. Although alternative cleanup activities have occurred on-site, a revised EPA decision document has not yet been issued.	NA
TRW	The remedy selected for the Site is no longer being operated.	Select a revised cleanup plan and prepare a revised EPA decision document.	Ongoing	A draft Focused Feasibility Study was completed in 2011 that presents cleanup alternatives for the site; the document has been reviewed by EPA but is currently undergoing further revision by the RP. A revised EPA decision document has not yet been issued.	NA
TRW	Groundwater contamination is inadequately characterized in the source area and down-gradient B3 zone.	Add source area and down-gradient B3 zone wells to the suite of annual monitoring wells.	Completed	Northrup Grumman mapped the subsurface at the TRW Site using Environmental Sequence Stratigraphy, and three hydrostratigraphic units were identified. In 2017, Northrup Grumman installed five additional wells to isolate each unit.	3/29/19

OU	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
TRW	Increasing chemical contaminant concentrations in down-gradient wells indicates that the remedy is not containing off-site migration.	Investigate and implement optimization options for the ISB to increase down-gradient capture zone groundwater contamination.	Completed	ISB has been successful at reducing concentrations of chemical contaminants in down-gradient wells.	1/2019
Offsite	Groundwater concentrations in the off-site plume indicate a potential for vapor intrusion in an area with 4 schools and over 100 residences. There has been limited indoor air sampling in the area.	Conduct additional vapor intrusion assessments at the Site.	Completed	Multiple indoor air sampling events have been conducted in more than 225 residential households and 40 school buildings, and 20 mitigation systems have been installed to mitigate indoor air TCE concentrations exceeding EPA's short-term and long-term screening levels. Outreach and sampling continue.	NA

3.2. Work Completed at the Site during this Five Year Review Period

Soil

At the TRW Site, Northup Grumman conducted a soil removal action in 2014 within the source area and nearby vicinity to remove residual source materials containing elevated chemical contaminant concentrations impacting groundwater quality. From September through November 2014, Northup Grumman removed approximately 590 tons of chemical contaminant-impacted soil from the source area. EPA did not identify a soil cleanup standard in the ROD; however, remediation criteria were identified for TCE (1,500 micrograms per kilogram [$\mu\text{g}/\text{kg}$]) and cDCE (500 $\mu\text{g}/\text{kg}$) for saturated soils specifically for this removal action.

Groundwater

The effectiveness of remediation activities at the AMD and TRW sites and Offsite OU is limited by continuing contaminant groundwater migration onto the sites from up-gradient sources, including the Signetics Site. To address this issue, the previous FYR recommended the establishment of a broader remedial strategy for regional groundwater restoration. In March 2019, EPA issued of an Administrative Order to Phillips for the Signetics Site to complete a focused Feasibility Study, to evaluate the potential for in-situ groundwater treatment technologies to accelerate the pace of the groundwater cleanup, and hence the cleanup of the adjacent AMD and TRW sites and Offsite OU.

In 2015, Northup Grumman mapped the subsurface within the TRW Site using Environmental Sequence Stratigraphy, in order to identify the primary flow path for the contaminants to migrate through the TRW Site and elucidate the depositional environment of alluvial sediments in the Triple Site area. Numerous hydrostratigraphic unit were identified in the A, B1, and B2 Zones. In 2017, Northup Grumman's consultant installed five additional wells to isolate primary hydrostratigraphic units in the B1 Zone. Two wells (T20B and T21B) were installed to monitor hydrostratigraphic unit 3 along the south and west property boundary. Three additional wells (T22B, T23B, and T24B) were installed along the northwest corner of the property to monitor each of the three primary B1 hydrostratigraphic units, respectively. The updated Conceptual Site Model reassigned well T-9C from the B2 Zone to the B3 Zone that addressed the issue of additional B3 contaminant characterization recommended in the previous FYR.

Vapor Intrusion

Offsite OU

Residential indoor air sampling to detect vapor intrusion in the Offsite OU began in January 2015. As of April 26, 2018, a total of 225 households in 134 buildings were sampled. Additionally, vapor intrusion assessments were conducted starting in January 2015 for the four schools within the Offsite OU. The data from these sampling events are further described in Section 4.2.3.

Mitigation efforts, when needed have been installed and have consisted of installation of sub-slab or sub-membrane depressurization systems, ventilation upgrades, conduit sealing, installation and operation of indoor air purifiers, Operations & Maintenance (O&M) measures, and post-mitigation confirmatory indoor air sampling to confirm success of mitigation measures at achieving protective levels of TCE. Two residences have denied access to install mitigation systems, and one residence denied access to allow sampling. EPA continues to work with these owners to allow access.

TRW

A Vapor Intrusion Evaluation Report was completed for the TRW Site in June 2015. This report summarized the vapor intrusion mitigation procedures conducted and the results of the confirmatory indoor air sampling. Mitigation activities included:

- additional former source area excavations to remove residual contaminated mass;
- installation of a passive sub-slab vapor collection system and repairs verified by a California-registered engineer;
- closure of potential conduits for the vapor intrusion pathway, including the interior groundwater monitoring wells;
- sealing of other potential vapor intrusion conduits, including slab piping penetrations, gaps between interior walls where soil is exposed, and expansion joints in the concrete slab;
- clean-out and visual inspection of the elevator shaft to verify its integrity; and
- confirmatory sub-slab and indoor air (10-hour TO-15 canister) sampling under ventilation-off conditions.

The most recent round of indoor air sampling at the TRW Site confirmed protective levels of TCE – levels of up to 0.58 µg/m³ – below EPA's long-term commercial Regional Screening Level (RSL) of 2

µg/m³ and EPA Region 9's Interim Accelerated Response Action Level of 7 µg/m³ (10-hour workday). These indoor air concentrations meet EPA's requirements for being protective of public health under a commercial-use scenario and demonstrate that the building is acceptable for occupancy.

AMD

A vapor intrusion evaluation was conducted by AMD in March 2013 the former AMD facility located at 901/902 Thompson Place. Indoor air samples were collected inside the building with the HVAC system deactivated to evaluate potential "worse-case" conditions. In 2014, AMD re-evaluated the data collected in 2013 to ensure consistency with USEPA's recent draft guidance and guidelines. AMD concluded that since vapor intrusion does not appear to be occurring based on the analysis, and since chemical concentrations in groundwater have been following decreasing trends, future vapor intrusion risk to the on-property building is very low.

4. Five-Year Review Process

4.1. Community Notification and Site Interviews

A public notice was made available in the *Sunnyvale Sun* on May 10, 2019 stating that there was a Five-Year Review and inviting the public to submit any comments to the EPA. The results of the review and the report will be made available at the information repository for each site uploaded to each site's webpage at:

AMD Site: <https://www.epa.gov/superfund/advancedmicrodevices>
 TRW Site: <https://www.epa.gov/superfund/trwmicrowave>
 Offsite OU: <https://www.epa.gov/superfund/triplesite>

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The results of these interviews are summarized below.

The communications officer for the City of Sunnyvale was interviewed. This individual expressed that the EPA team had been very receptive to City officials and their input and had been timely in notifying residents with developing site information. No issues or concerns with respect to the cleanup were raised.

The Environmental Health and Safety Manager for AMD was also interviewed. This individual expressed that the project approach is completing the necessary work to protect human health and the environment and allow for continued use of the AMD property. Communication with EPA has been sufficient and the company does not have any concerns. It was also noted that an individual was found camping in the treatment system compound in 2017, but no damage or theft was noted. The police were notified and they assisted with removal of the individual's possessions from the compound, and no further action was required.

Finally, the principal of San Miguel Elementary School was interviewed. The principal expressed overall positive sentiments towards EPA and the progress of the indoor air investigation and groundwater cleanup. The principal noted a positive relationship with EPA and that the school has felt well informed.

One suggestion shared with EPA was to be informed further in advance of when any sampling events were to occur at the school.

The full list of interview questions and responses can be found in Appendix E.

4.2. Data Review

The data review for this FYR focused on data collected during the past five years (2014 through 2018) from monitoring reports, quarterly reports, and other associated reports provided to EPA. The following sections are organized by soil, groundwater, and vapor intrusion for each site or OU to evaluate the effectiveness of the ROD remedies during the review period.

4.2.1. Soil

The completion of the soil removal action at the TRW Site during the review period (2014 – 2018) should reduce VOC impacts to groundwater in the source area. Twelve of 39 sample locations from the excavated materials contained concentrations of TCE and/or cDCE above the remediation criteria. Confirmation samples were collected from the side-walls of the excavation to confirm the contaminant levels remaining, with soils showing TCE and cDCE levels above the remediation criteria remaining in place at depths of 25 feet or greater (Northrop Grumman, 2015). Two exceptions included samples SB-8 and SB-9, which were advanced at an angle below the building footing and were not practicable to excavate.

4.2.2. Ground Water

4.2.2.1 AMD 901/902 Thompson Place Site

The ISB program has been effective in all groundwater treatment zones at the AMD Site. TCE concentrations have decreased significantly since treatment. Breakdown products from TCE, including cDCE and vinyl chloride, are evident. The majority of contaminant mass is contained in the A and B1 zones. AMD's ISB program is successful in reducing chemical contaminants, and chemical contaminant concentrations are lower at the downgradient property boundary than the upgradient property boundary, indicating that containment of the contaminants is occurring.

Contaminated groundwater from the Signetics Site to the west likely influences groundwater concentrations at the AMD Site. The groundwater direction for the A, B1, B2, and B3 zones remains to the north-northeast, and GWETS operation at the Signetics Site does not appear to shift groundwater flow back toward the west, thus contaminated groundwater from the Signetics Site likely flows onto the AMD Site. Freon 113, which was used at the Signetics Site but not at the AMD Site, has been found in AMD well 37-S.

Fluctuations in groundwater elevation range from 3 to 5 feet in all shallow aquifers, typical of seasonal variation and operation of the nearby GWETS. The current vertical gradient between the shallow aquifers (A, B1, and B2) is upward. Stable TCE trends at concentrations below the MCLs in the underlying B3 zone confirm vertical containment of the plume and upward gradients.

Table 4. AMD Groundwater Concentration Data

Concentrations reported in micrograms per liter (µg/L)

Well ID	TCE		cDCE		Vinyl Chloride		Mole Fraction Ethene & Ethane ¹
	Start of ISB (2005)	Most Recent (2018)	Start of ISB (2005)	Most Recent (2018)	Start of ISB (2005)	Most Recent (2018)	2018
A Zone							
16-S	6.1 ²	<0.50 ³ (-100%) ⁴	29	3.0 (-90%)	37	29 (-22%)	28%
23-S	37	38 (+3%)	84	42 (-50%)	31	0.60 (-98%)	3.0%
28-MW	10	<0.50 (-100%)	26	0.71 (-97%)	28	14 (-50%)	60%
DW-2	3.0 ⁵	<0.50 ⁶ (-100%)	110	<0.50 (-100%)	<0.7	<0.50 (0%)	100%
X2A	200	<5.0 (-100%)	230	49 (-79%)	62	980 (+1,481%)	11%
B1 Zone							
16-D	740	<0.50 ⁷ (-100%)	970	2.1 (-100%)	45	7.7 (-83%)	98%
23-D	230	290 (+26%)	390	3.7 (-99%)	56	<2.5 (-100%)	0.057%
PMW-2-1	82	<50 (-100%)	6,700	4,800 (-28%)	2,300	430 (-81%)	4.9%
DW-1	440	<0.50 ⁶ (-100%)	3,700	0.78 (-100%)	32	3.0 (-91%)	96%
DW-7	300	69 (-77%)	100	130 (+30%)	4.6	4.3 (-7%)	0.26%
X1B	360	<10 (-100%)	1,600	300 (-81%)	120	140 (+17%)	3.5%
X2B1	420	150 (-64%)	420	110 (-74%)	41	7.8 (-81%)	5.4%
B2 Zone							
PMW-2-3	290	270 (-7%)	440	75 (-83%)	24	11 (-54%)	1.3%

4.2.2.2 TRW Microwave Site

Progress at the TRW Site is slow despite soil removal actions and enhanced anaerobic biodegradation (EAB) treatment because contaminant concentrations are influenced by upgradient contaminated groundwater sources, including the Signetics Site. Groundwater contaminant concentrations throughout the TRW Site have remained consistent or decreased slightly during the review period. A and B1 zone TCE concentrations dropped significantly after the EAB program began in 2000. Prior to the 2014 source area soil excavation at the TRW Site, the source area contained the highest concentrations of contaminants. Following excavation, the highest concentrations at the TRW Site are located either up-gradient or cross-gradient to the source area. In general, chemical contaminant concentrations decrease as groundwater moves northward through the TRW Site. In addition, Freon 113, which was not used at the TRW Site but was used at the Signetics Site, was found in on-site wells. Isotope testing during the EAB pilot test indicates that the EAB pilot test is effective in treating source area contamination, but that off-site migration of contaminants onto the site influences the downgradient plume.

Subsurface investigations at the TRW Site in 2015 and 2016 using Environmental Sequence Stratigraphy identified numerous hydrostratigraphic units present in the A, B1, and B2 aquifer zones – underground channels through which groundwater can flow. Hydrostratigraphic unit 1 is hydraulically linked to the TRW source area. Hydrostratigraphic unit 2 is a slightly deeper unit, hydraulically linked to off-site sources. Hydrostratigraphic unit 3 is at a shallower depth than hydrostratigraphic units 1 and 2. At the time of the investigation, hydrostratigraphic unit 3 was not being monitored by any existing wells. In 2017, the Northrop Grumman's consultant installed five additional wells to monitor each hydrostratigraphic unit. Two wells were installed to monitor hydrostratigraphic unit 3 along the south and west property boundary, respectively. Three wells were installed along the northwest corner of the property to monitor hydrostratigraphic units 1, 2, and 3, respectively.

The groundwater flow directions for the A, B1, and B2 zones at the TRW Site range from the north to the north-northeast. However, the hydrostratigraphic units within the aquifer zone can also modify the flow pathway on a local scale. Another factor influencing groundwater flow direction is the operation of the groundwater extraction and treatment systems (GWETs) at two adjacent sites (Signetics and AMD 915).

Table 5. TRW Groundwater Concentrations Trends

TRW Well ID	GW Zone	Analyte	n	Coefficient of Variation (COV)	MK Statistic (S)	Confidence Factor (%)	2017 Concentration	Trend
Upgradient Wells								
T-7A	A	TCE	11	0.4	-11	77.7	160	Stable
		cDCE	11	0.55	12	79.9	84	No Trend
T-7B	B1 HSU1	TCE	10	0.38	-8	72.9	190	Stable
		cDCE	10	0.4	-4	59	12	Stable
Source Area Wells								
T-14A	A	TCE	16	0.96	8	62.2	55	No Trend
		cDCE	16	0.33	49	98.6	55	Increasing
T-8B	B1 HSU3	TCE	11	0.78	-32	99.4	5	Decreasing
		cDCE	11	0.74	11	77.7	420	No Trend
T-12C	B2	TCE	10	1	-13	85.4	140	Stable
		cDCE	10	1.18	-11	81	6.3	No Trend
Downgradient Wells								
T-9A	A	TCE	11	0.16	-1	50	48	Stable
T-16A	A	TCE	10	0.32	1	50	59	No Trend
		cDCE	10	0.14	13	85.4	72	No Trend
T-10B	B1 HSU1	TCE	10	0.54	-19	94.6	<0.5	Probably Decreasing
		cDCE	10	0.55	19	91.8	150	Probably Increasing
T-11C	B2	TCE	10	0.84	10	78.4	310	No Trend
		cDCE	10	0.8	10	78.4	26	No Trend
Cross gradient Well								
T-17B	B1 HSU2	TCE	13	0.58	3	54.8	210	No Trend
		cDCE	13	0.37	23	88.3	370	No Trend

4.2.2.3 Offsite OU

Groundwater restoration within the Offsite OU did not progress substantially towards reaching the RAO of groundwater restoration within the review period. During the review period, dissolved concentrations of TCE, cDCE, and vinyl chloride exceeded MCLs in one or more zones of the shallow aquifer, and Mann-Kendall analysis indicates that TCE concentrations in all aquifer zones are stable or decreasing (Appendix B), however concentrations throughout the Offsite OU are elevated one or two orders of magnitude above ROD remediation level of 5 mg/L. While there is a current trend of decreasing concentrations in several wells, the projection for aquifer restoration will be in 2060-2080 timeframe; this is well beyond the ROD-estimated projected restoration time of 2027.

Table 6. Linear projections for OOU reaching ROD Remediation Levels for TCE

Well	Projected Year Cleanup
S077A	2080 (approx.)
COM39A	2050
COM60B1	2060
S077B1	2043
COM06B2	2080 (approx.)
COM60B2	2080 (approx.)

While recognizing there is a high potential for subsurface complexities at the Offsite OU, the current understanding of the subsurface is simplified and does not account for the potential for highly channelized flow. Greater detail of the subsurface is needed to identify and adequately map the potential migration pathways such that the Offsite OU plume geometry, configuration, and chemical content can be better understood and adequately remediated.

The remedy appears to be providing hydraulic control of contaminant migration in groundwater from upgradient sources and preventing further downgradient migration in the B1 and deeper aquifer zones. It is unclear if vertical containment is occurring due to the complexities of the subsurface and the elevated concentrations. The concentration footprint of the plume has not significantly changed within the review period indicating containment is occurring. The groundwater flow direction at the eastern portion of the plume has changed following startup of the AMD 915 Site extraction wells, possibly indicating limited or incomplete capture along the eastern property boundaries.

Table 7. Off-site Operable Unit Groundwater Concentration Trends

Well ID	GW Zone	n	Coefficient of Variation	MK Statistic	Confidence Factor (%)	2017 TCE Concentration (ug/l)	Trend
Southern Portion of Plume (downgradient of Signetics)							
S075A2	A	11	0.62	-28	98.4	140	Decreasing
S057B	B1	11	2.42	-35	99.7	1	Decreasing
Duane Avenue							
COM06A	A	11	0.19	-27	98	180	Decreasing
COM06B2	B2	11	0.15	-10	75.3	540	Stable
COM09B3	B3	11	0.13	-25	97	580	Decreasing
Center of Plume South of San Miguel School							
COM01A	A	11	0.47	-10	75.3	29	Stable
COM01B1	B1	11	0.16	-17	89.1	130	Stable
COM01B2	B2	11	0.1	-11	77.7	210	Stable
Center of Plume East of San Miguel School							
COM04A	A	11	0.13	-22	94.9	26	Probably decreasing
Blythe Avenue - west San Miguel School - Offsite							
COM55A	A	11	0.34	-5	61.9	14	Stable
Center of Plume North of San Miguel School							

Well ID	GW Zone	n	Coefficient of Variation	MK Statistic	Confidence Factor (%)	2017 TCE Concentration (ug/l)	Trend
COM03A	A	11	0.1	-17	89.1	120	Stable
COM03B	B1	11	0.1	-17	89.1	57	Stable
COM03B2	B2	11	0.11	8	70.3	250	No Trend
COM06B3	B3	11	0.1	-23	95.7	440	Decreasing
COM06B4	B4	11	0.24	-3	56	89	Stable
Furthest downgradient & Offsite							
COM63-B1	B1	11	0.59	-46	99.9	22	Decreasing

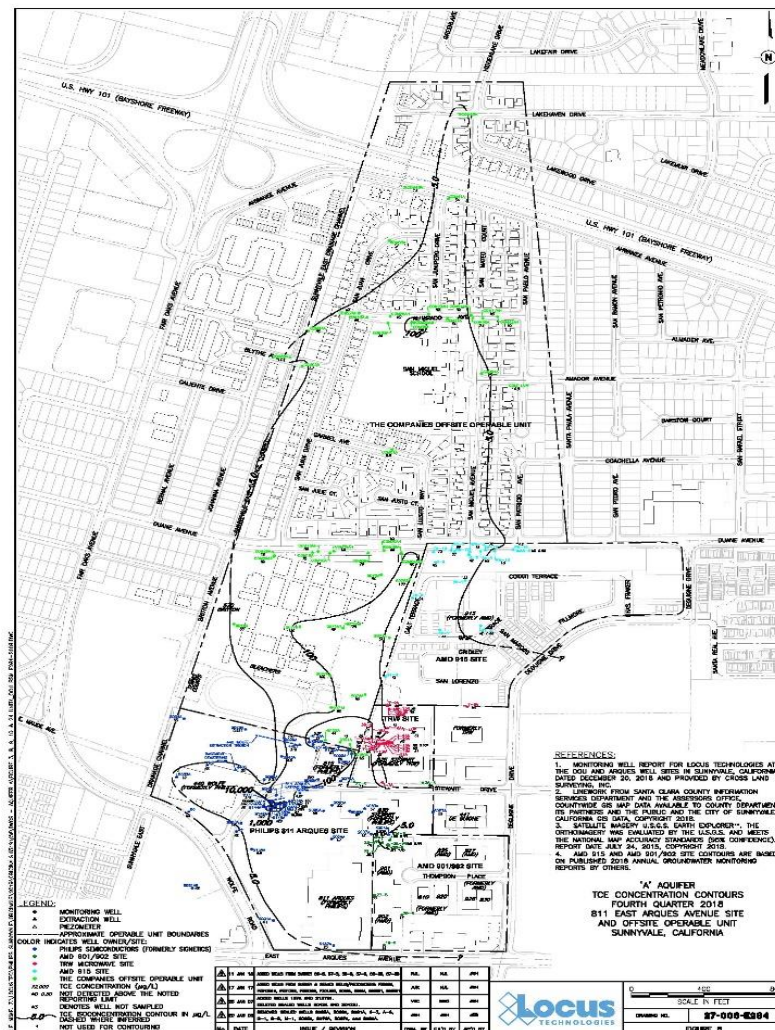


Figure 5. A Zone Aquifer TCE Concentrations at AMD, TRW, Signetics, and Offsite 2018

4.2.3. Vapor Intrusion

On August 11, 2014, EPA issued a Notice of Delinquency to the companies responsible for the AMD, TRW, and Signetics sites and Offsite OU regarding vapor intrusion. Philips's previous investigations in the Offsite OU, initiated in 2004 and limited in scope, did not show TCE levels of concern in the indoor locations sampled. In 2015, EPA issued an Administrative Order to Philips requiring comprehensive indoor air investigations and mitigation efforts at all four neighborhood schools and all residential buildings within the Offsite OU. These efforts are ongoing as of the writing of this FYR. To date, more than 225 residences and 40 school buildings have been sampled, and 20 mitigation systems have been installed in homes and classrooms to address findings of unacceptable TCE in indoor air. EPA also oversaw vapor intrusion assessment and mitigation efforts in commercial buildings at the AMD and TRW sites. The findings are summarized below.

4.2.3.1 TRW Microwave Site

Northrop Grumman completed a vapor intrusion assessment at the TRW Site in June 2015. Indoor air samples were collected under ventilation-on and -off conditions, which showed exceedances of EPA's health-protective screening levels for commercial buildings. To reduce the potential for vapor intrusion, Northrop Grumman subsequently completed a soil excavation of residual materials within the source area and removed interior monitoring wells prior to the redevelopment of the one on-site building. Potential conduits for vapor intrusion were sealed, including piping penetrations through the slab, expansion joints, and gaps between interior walls where soil is exposed. In addition, a passive sub-slab vapor collection system was installed, with the capability of being converted to an active, pumping system in the future, if necessary.

Post-mitigation sampling following these efforts showed TCE concentrations of up to 0.58 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) in indoor air samples, below EPA's long-term commercial RSL of 3 $\mu\text{g}/\text{m}^3$ and EPA Region 9's Interim Accelerated Response Action Level of 7 $\mu\text{g}/\text{m}^3$ (for a 10-hour workday). These indoor air concentrations meet EPA's requirements for being protective of public health under a commercial-use scenario and establish that the building is acceptable for occupancy.

4.2.3.2 AMD 901/902

A vapor intrusion evaluation was conducted by AMD in March 2013 at the former AMD facility located at 901/902 Thompson Place. Indoor air samples were collected inside the building with the HVAC system deactivated to evaluate potential "worse-case" conditions. Six VOCs (PCE, TCE, cDCE, 1,4-DCB, 1,1,1-trichloroethane, and Freon 113) were detected in at least one indoor air sample. All detections were at concentrations less than their RSLs, with the exception of the common household chemical 1,4-DCB, which was detected at concentrations greater than its RSL. Based on the current use of the building as a storage facility, the presence of 1,4-DCB found in mothballs, mildew prevention products, or other such products in storage units would be expected.

In 2014, AMD re-evaluated the data collected in 2013 to ensure consistency with USEPA's recent draft guidance and guidelines. AMD concluded that since vapor intrusion does not appear to be occurring based on the analysis, and since chemical concentrations in groundwater have been following decreasing trends, future vapor intrusion risk to the on-property building is very low.

4.2.3.3 Offsite OU Residences

Residential indoor air sampling in the Offsite OU under EPA oversight began in January 2015 and is ongoing. As of April 26, 2018, a total of 225 households in 134 buildings were sampled. Sampling data was organized into five groups (Groups 1 through 5, Appendix B) that relate the TCE indoor air sampling results and building location to the underlying TCE groundwater plume. The TCE plume is defined by the area where TCE levels in groundwater exceed the EPA's MCL of 5.0 µg/L. Sampling data was compared to EPA's long-term residential RSL for indoor air of 0.48 µg/m³ and EPA's short-term residential RSL of 2.0 µg/m³. Multiple lines-of-evidence were used to determine if the TCE levels detected were due to vapor intrusion, attributable to elevated outdoor air TCE levels, or related to a confounding indoor source of TCE.

Group 1 households (which total 33) are in buildings located *outside* of the shallow groundwater TCE plume, based upon the current data set, and defined by the MCL of 5.0 µg/L, but *within or in very close proximity to the Offsite OU* as it is defined in the ROD. Group 1 residences show *no evidence of vapor intrusion*, i.e., have TCE results less than the long-term screening level of 0.48 µg/m³, or TCE results between 0.48 and the short-term screening level of 2.0 µg/m³, but likely non-vapor intrusion related, for example, attributable to elevated outdoor air TCE levels or an indoor source.

Similar to Group 1, Group 2 households (which total 97) are in buildings showing *no evidence of vapor intrusion*. However, Group 2 residences are located *directly over* the shallow groundwater TCE plume.

Group 3 households (which total two) are in buildings located *directly over* the groundwater TCE plume with indoor air TCE results *showing some evidence of vapor intrusion, but within EPA's Superfund health-protective risk management range* of 0.48 to 2.0 µg/m³.

Residences falling within Groups 1 through 3 have been identified by EPA as warranting no further action with respect to the vapor intrusion pathway.

Group 4 households (which total 31) are in buildings located *directly over* the groundwater TCE plume with TCE results *showing evidence of unacceptable vapor intrusion, exceeding the short-term screening level of 2 µg/m³, warranting mitigation*. For these buildings showing a need for mitigation, TCE in the nearest shallow groundwater monitoring wells was detected at levels of 20 – 30 µg/L and above. Mitigation efforts at these buildings have been completed, specifically, installation of active sub-slab and sub-membrane depressurization systems and post-mitigation sampling and maintenance plans to confirm continued effectiveness of the mitigation systems. Interim mitigation measures have also included the installation of air purifiers, conduit sealing, and one-way floor drains.

Group 5 households (which total 62) are in buildings located *directly over* the groundwater TCE plume where *preemptive mitigation has been completed or is currently under consideration* to address potential unacceptable vapor intrusion. Similar to Group 4 residences (which showed evidence of unacceptable vapor intrusion), Group 5 residences are also located in *close proximity* to shallow groundwater monitoring wells showing TCE at levels of 20 – 30 µg/L and above. TCE results in Group 5 residences were either elevated as compared to outdoor air TCE levels, showing some evidence of vapor intrusion, but less than the short-term screening level of 2.0 µg/m³ or in close proximity to and of similar construction to a Group 4 building.

4.2.3.4 Offsite OU Schools

Indoor air sampling at school buildings in the Offsite OU under EPA oversight began in January 2015 and is ongoing. A total of four schools, including 40 buildings, have been sampled under both heating and ventilation systems (HVAC)-off and HVAC-on conditions (Appendix B). Unacceptable levels of vapor intrusion were detected in eight school buildings, at which mitigation measures were implemented to prevent elevated levels of TCE vapors from accumulating indoors. In addition, preemptive mitigation systems were installed in four school buildings, three of which were new buildings where the mitigation systems were integrated into the new construction.

Mitigation measures in school buildings included the installation of active, sub-slab and sub-membrane depressurization systems, placement of indoor air purifiers, upgrades and operational modifications to HVAC systems, conduit sealing, installation of one-way floor drains, and post-mitigation sampling and maintenance plans to confirm continued effectiveness of the mitigation systems.

4.2.3.5 Outdoor Air

Sampling of ambient outdoor air (which occurs during each indoor air sampling event) has occurred regularly in the Offsite OU since January 2015. The results of this outdoor air sampling have shown varying levels of TCE with a general upward trend. Data received more recently in May 2019 from Philips showed outdoor air TCE levels of up to 3.6 $\mu\text{g}/\text{m}^3$ during the October 2018 and January 2019 sampling events at the Signetics Site (where the treatment system for the AMD and TRW sites and Offsite OU TCE groundwater plume is located and where a sub-slab depressurization system has recently been installed at a commercial-type building. (Figure 6) While the highest outdoor air TCE measurements have generally been observed in the November – January timeframe, these spikes appear to be increasing over time.

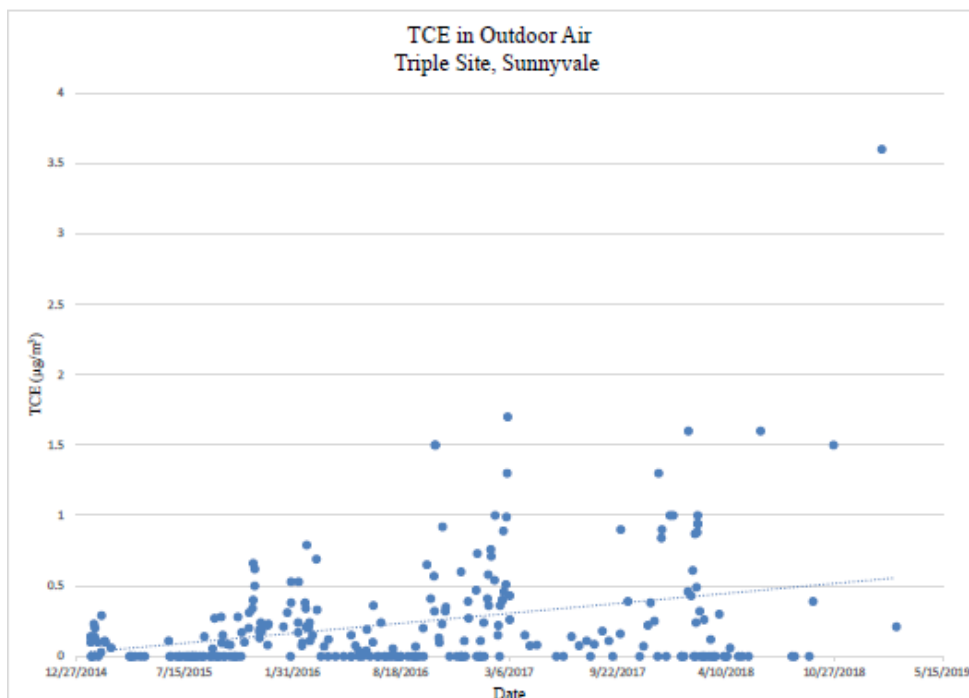


Figure 6. TCE Concentrations in Outdoor Air

4.3. Site Inspection

The inspection of the AMD and TRW sites and Offsite OU was conducted on March 14, 2019. In attendance were Melanie Morash, EPA, Benino McKenna, USACE, and personnel and contractors from AMD, Northrop Grumman Systems Corporation, and Philips; see Appendix F for full list. The purpose of the inspection was to assess the protectiveness of the remedy.

The participants completed a site walk, visiting all three sites, as well as the Signetics Site. The GWETS at the Offsite OU and Signetics Site appeared to be in good condition. Associated site extraction and monitoring wells were observed throughout all the sites, and all appeared to be in good condition. Injection wells for the EAB remediation were viewed at the TRW Site, as well as ISB injection wells at the AMD Site. All injection wells appeared to be in good condition and functioning properly.

The full trip report and photographs can be viewed in Appendix F.

5. Technical Assessment

5.1. *Question A: Is the remedy functioning as intended by the decision documents?*

The groundwater extraction and treatment remedies, and the addition of in-situ pilot tests at the AMD and TRW sites have resulted in significant decreases in concentrations of chemical contaminants since operation began. Currently, the systems at the AMD and TRW sites are not being operated, and in-situ bioremediation is being implemented to further cleanup contaminants. These in-situ efforts, combined with the institutional controls currently being implemented at the AMD and TRW sites, and the mitigation system in place at the TRW site, are providing protectiveness. Achievement of cleanup goals will remain a challenge as long as the migration of these chemical contaminants from upgradient sources at the Signetics Site persists.

The selected remedy for the Offsite OU is currently in operation and is functioning as intended with regard to controlling contaminant migration in groundwater. Groundwater restoration within the Offsite OU has not progressed substantially towards reaching the RAO of groundwater restoration within the review period. While there is a current trend of decreasing concentrations in several wells, the projection for aquifer restoration will be in 2060-2080 timeframe; this is well beyond the ROD-estimated projected restoration time of 2027.

A 2005 environmental covenant for the AMD Site prohibits residential development; construction or use of medical facilities, day-care centers, or schools; or use of groundwater or excavation of soils without prior approval of the Regional Board. No activities were observed at the AMD Site that violate the covenant. However, this 2005 environmental covenant does not comply with Civil Code section 1471. A new covenant which complies with Civil Code section 1471 and addresses vapor intrusion should be recorded after the new remedy is selected.

A 1992 covenant and agreement for the TRW Site prohibits the use of groundwater; use of property for day-care; or excavation of soils without prior approval of the Regional Board until cleanup levels are achieved. No activities were observed at the TRW Site that violate the covenant.

The ROD does not require institutional controls to prevent use of the shallow groundwater for the Offsite OU, however the Santa Clara Valley Water District (SCVWD) regulates the construction, destruction, and maintenance of wells in the Santa Clara County under Ordinance 90-1; well installations are prohibited without a permit from the SCVWD.

5.2. Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

No, the exposure assumptions used at the time are not still valid. The vapor intrusion pathway is complete and was not included in the ROD.

Indoor air sampling was conducted within the last five years. Results from these sampling events indicate that the vapor intrusion pathway is complete in buildings in the Offsite OU. Wherever TCE levels have been measured in indoor air above health-protective screening levels, mitigation systems have been installed where property owners have granted access. All school buildings with measured indoor air exceedances of EPA's health-protective screening levels have been provided with mitigation systems. EPA is working with the Philips on a supplemental school sampling plan and a residential preemptive mitigation framework to guide future response work and reduce the extent of back-and-forth sampling.

Vapor intrusion was also evaluated in the AMD and TRW sites (in 2014 and 2015 respectively). The vapor intrusion evaluation at the AMD Site showed no evidence of potential indoor air exposures due to groundwater contamination. Vapor intrusion evaluations performed at the TRW Site indicated that TCE concentrations in indoor air near the former source area posed an inhalation risk. These risks were addressed via the mitigation activities completed in 2015. Indoor air confirmation sampling conducted subsequent to these mitigation activities confirmed the effectiveness of these measures.

However, investigation of potential TCE impacts to outdoor ambient air from the groundwater treatment system for the AMD and TRW sites and Offsite OU, which is located within the Signetics Site, is warranted, as well as potential impacts from emissions from the residential, school, and commercial vapor intrusion mitigation systems that have been installed to address inhalation risks.

There have been no changes to ARARs (Appendix C) that would affect the protectiveness of the groundwater remedy for the AMD and TRW sites and Offsite OU. Groundwater cleanup standards have not changed since the ROD was issued. No new contaminants have been identified since the ROD.

Land use has not changed at the AMD and TRW sites and Offsite OU since the last FYR. An environmental covenant and a covenant and agreement for the AMD and TRW sites, respectively, are in place that prohibits installation of groundwater wells for domestic use at the AMD and TRW sites.

5.3. Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no other information known at this time that calls into question the protectiveness of the remedy.

6. Issues/Recommendations

Table 8. Issues and Recommendations Identified in the Five-Year Review

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): AMD Site	Issue Category: Remedy Performance			
	Issue: The remedy selected for the AMD Site is no longer being operated and does not address vapor intrusion.			
	Recommendation: Select a revised remedy which also addresses potential vapor intrusion in the event of future land use changes.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	9/1/2022
OU(s): TRW Site	Issue Category: Remedy Performance			
	Issue: The remedy selected for the TRW Site is no longer being operated.			
	Recommendation: Select a revised remedy which incorporates long-term stewardship measures for the current vapor intrusion mitigation measures in place, as well as addresses potential vapor intrusion in the event of future land use changes.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	9/1/2022
OU(s): Offsite OU	Issue Category: Remedy Performance			
	Issue: Outdoor air TCE levels have shown a generally upward trend over time since regular sampling commenced in January 2015.			
	Recommendation: Investigate contributions to outdoor air TCE levels from fugitive emissions from the groundwater treatment system and emissions from the vapor intrusion mitigation systems.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	9/1/2022
OU(s): Offsite OU	Issue Category: Remedy Performance			
	Issue: The remedy selected for the Offsite OU will not be able to achieve the remedial action objective of restoration of groundwater in a reasonable timeframe, as defined in the ROD.			

	Recommendation: Conduct remedy performance optimization efforts, after investigating whether hydrogeology is adequately characterized. A revised remedy may be needed to achieve the RAOs.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	9/1/2022
OU(s): Offsite OU	Issue Category: Changed Site Conditions			
	Issue: Indoor air sampling results indicate that the vapor intrusion pathway is complete in buildings in the Offsite OU			
	Recommendation: Select a revised remedy which addresses vapor intrusion.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	9/1/2022

7. Protectiveness Statement

Table 9. Protectiveness Statement

Protectiveness Statement(s)	
<i>Operable Unit:</i> AMD Site	<i>Protectiveness Determination:</i> Short-term Protective
<p><i>Protectiveness Statement:</i> The remedy at the AMD Site currently protects human health and the environment because exposure pathways for soil and groundwater are being controlled and there is no evidence of unacceptable vapor intrusion for the current commercial land use. However, in order for the remedy to be protective in the long-term, a revised final groundwater remedy for the AMD Site should be selected, as the remedy selected in the 1991 ROD is no longer operating. The revised remedy should also address potential vapor intrusion in the event of future land use changes, as vapor intrusion was not addressed in the 1991 ROD and record a new environmental.</p>	

Protectiveness Statement(s)

Operable Unit: TRW Site *Protectiveness Determination:*
Short-term Protective

Protectiveness Statement: The remedy for the TRW Site currently protects human health and the environment because exposure pathways for soil and groundwater are being controlled. Exposure pathways to contaminated groundwater that could result in unacceptable risks are prevented through a covenant and agreement. The risk due to vapor intrusion for the current commercial land use has been addressed. However, in order for the remedy to be protective in the long-term, a revised soil and groundwater remedy for the TRW Site should be selected, as the remedy selected in the ROD is no longer operating. The revised remedy should also address vapor intrusion assessment and response procedures to ensure the long-term stewardship of the vapor intrusion mitigation measures currently in place, as well as potential vapor intrusion in the event of future land use changes, as vapor intrusion was not addressed in the 1991 ROD.

Protectiveness Statement(s)

Operable Unit: Offsite OU *Protectiveness Determination:*
Short-term Protective

Protectiveness Statement: The remedy for the Offsite Operable Unit currently protects human health and the environment because exposure pathways for soil and groundwater are being controlled. The risk due to vapor intrusion for the current residential use is being addressed through installation of mitigation measures. However, in order for the remedy to be protective in the long-term, a remedy performance optimization and updated site conceptual model is needed. A revised remedy is needed to achieve the RAOs and to address vapor intrusion assessment and response procedures to ensure the long-term stewardship of the vapor intrusion mitigation measures currently in place. Finally, an investigation of the contributions to outdoor air TCE levels from fugitive emissions from the groundwater treatment system and emissions from the vapor intrusion mitigation systems is needed.

8. Next Review

The next FYR report for the AMD Site, the TRW Site and the Offsite OU is required five years from the completion date of this review.